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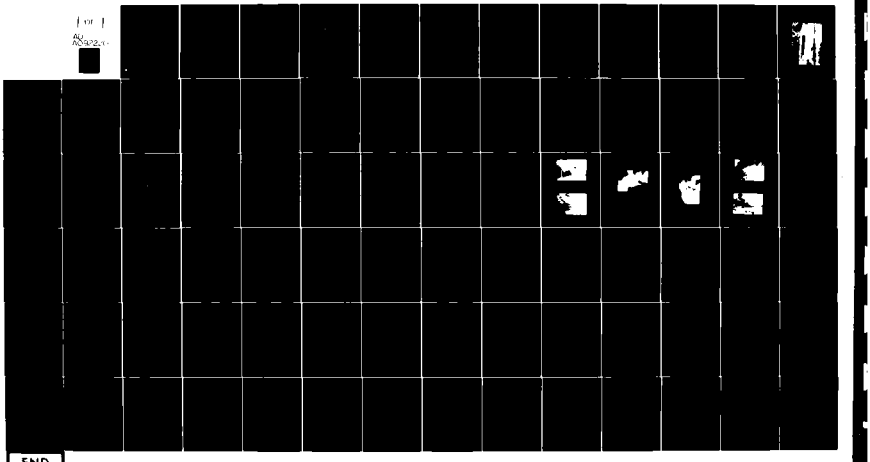

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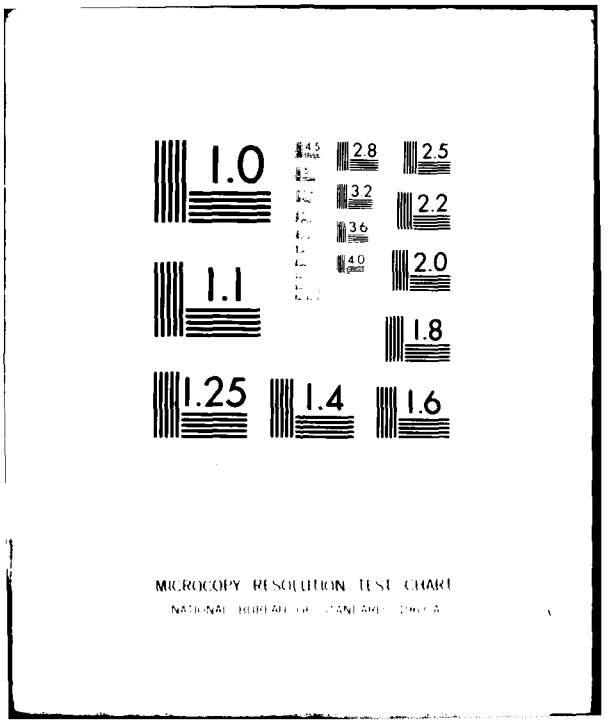
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National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Pascack Brook
Lake Suzanne
Rockland County
Hudson River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and the visual inspection of Lake Suzanne did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Using the Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding approximately 4 percent of the PMF. The overtopping of the dam could cause the erosion of both abutments and the downstream face of the dam, particularly in the vicinity of the spillway-embankment contact resulting in dam failure, thus significantly increasing the hazard to the loss of life downstream. The spillway is, therefore, adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to loss of life downstream of the dam.

Structural stability analysis based on available information and the visual inspection indicates that the stability of the spillway section against overturning and sliding is inadequate for all loading conditions.

notification to the owner, [illegible] be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. The results of these investigations will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the one-half PMF. Within twelve months of the date of notification to the owner, modifications to the structure, deemed necessary as a result of studies, should have been completed. At the same time, a detailed investigation of the [illegible] and implemented during periods of unusually heavy precipitation. Also, around-the-clock surveillance of the structure must be provided during these periods.

In addition, the dam has a number of problem areas which, if left uncorrected, have the potential for the development of hazardous conditions and must be corrected within one year. These areas are:

1. Backfill the eroded area of the embankment downstream of the left spillway training wall (spillway-embankment contact).

2. The reservoir drain should be returned to operating condition.

3. Backfill the gully at the right abutment and divert the surface runoff from pavement and adjacent areas away from the right abutment.

4. Remove all brush and trees from the crest, embankment slopes and downstream channel. Provide a program of periodic inspection and cutting and mowing of the embankment surfaces and the downstream channel.

5. Remove and haul away debris from the downstream channel and at the spillway crest. Provide a program of periodic inspection and removal.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The aforementioned emergency action plan should be maintained and updated periodically during the life of the structure.

HUDSON RIVER BASIN

LAKE SUZANNE

ROCKLAND COUNTY, NEW YORK
INVENTORY NO. N.Y. 760

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1980

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National Dam Safety Program

LAKE SUZANNE

~~ROCKLAND COUNTY, NEW YORK~~
~~INVENTORY NO.~~ (Number) N.Y. 760

Hudson River Basin
Rockland County, New York.

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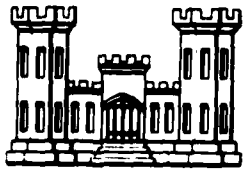

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NEW YORK DISTRICT CORPS OF ENGINEERS

AUGUST 1980

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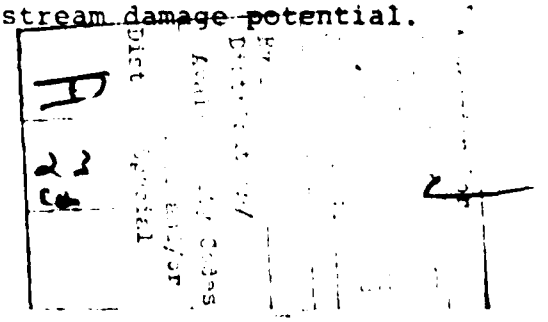
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C., 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE SUZANNE DAM
I.D. NO. N.Y. 760
D.E.C. NO. 196D-4179
HUDSON RIVER BASIN
ROCKLAND COUNTY, NEW YORK

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE SUZANNE DAM
I.D. NO. N.Y. 760
D.E.C. NO. 196D-4179
HUDSON RIVER BASIN
ROCKLAND COUNTY, NEW YORK

Name of Dam:	Lake Suzanne, N.Y. 760
State Located:	New York
County Located:	Rockland
Basin:	Hudson River
Stream:	Pascack Brook (a tributary of Hackensack River)
Date of Inspection:	July 26, 1980

ASSESSMENT

The examination of documents and the visual inspection of Lake Suzanne did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using the Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding approximately 4 percent of the PMF. The overtopping of the dam could cause the erosion of both abutments and the downstream face of the dam, particularly in the vicinity of the spillway-embankment contact resulting in dam failure, thus significantly increasing the hazard to the loss of life downstream. The spillway is, therefore, adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to loss of life downstream of the dam.

Structural stability analysis based on available information and the visual inspection indicates that the stability of the spillway section against overturning and sliding is inadequate for all loading conditions.

It is therefore recommended that within 3 months of notification to the owner, detailed hydrologic/hydraulic investigations of the structure should be undertaken to more accurately determine the site specific characteristics of the watershed and their affect upon the overtopping potential of the dam. The results of these investigations will determine the appropriate remedial measures which will be required to achieve a spillway capacity adequate to discharge the outflow from at least the one-half PMF. Within twelve months of the date of notification to the owner, modifications to the structure, deemed necessary as a result of studies, should have been completed. At the same time, a detailed investigation of the structural stability of the spillway should be performed. In the interim, a detailed emergency action plan must be developed and implemented during periods of unusually heavy precipitation. Also, around-the-clock surveillance of the structure must be provided during these periods.

In addition, the dam has a number of problem areas which, if left uncorrected, have the potential for the development of hazardous conditions and must be corrected within one year. These areas are:

1. Backfill the eroded area of the embankment downstream of the left spillway training wall (spillway-embankment contact).

2. The reservoir drain should be returned to operating condition.

3. Backfill the gully at the right abutment and divert the surface runoff from pavement and adjacent areas away from the right abutment.

4. Remove all brush and trees from the crest, embankment slopes and downstream channel. Provide a program of periodic inspection and cutting and mowing of the embankment surfaces and the downstream channel.

5. Remove and haul away debris from the downstream channel and at the spillway crest. Provide a program of periodic inspection and removal.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The aforementioned emergency action plan should be maintained and updated periodically during the life of the structure.

Eugene O'Brien

Eugene O'Brien, P.E.
New York No. 29823

Approved by:

Col. W. M. Smith, Jr.
New York District Engineer

Date: 30 SEP 80

1. OVERVIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
LAKE SUZANNE DAM
I.D. NO. N.Y. 760
D.E.C. NO. 196D-4179
HUDSON RIVER BASIN
ROCKLAND COUNTY, NEW YORK

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the State of New York, Department of Environmental Conservation, by letter dated 7 January 1980, in fulfillment of the requirements of the National Dam Inspection Act, Public Law 92-367, 8 August 1972.

b. Purpose of Inspection

This inspection was conducted to evaluate the existing conditions of the dam, to identify deficiencies and hazardous conditions, to determine if these deficiencies constitute hazards to life and property, and to recommend remedial measures where required.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam

The Lake Suzanne Dam consists of an earth embankment with a concrete spillway located on the right side of the embankment. From available information (See Appendix A), the embankment is estimated to be about 50 feet long and has a maximum height of about 8 feet. The width of the crest varies from 10 to 30 feet. The upstream slope is estimated to be about 1 vertical on 4 horizontal and the downstream slope, 1 vertical on 5 horizontal. It should be noted that during the visual inspection, the left abutment and the downstream toe of the embankment could not be accurately located because of flat topography, heavy vegetation and ground cover.

The spillway is about 24 feet wide, ungated and has a sill 2 feet wide and 1.6 feet below the top of the dam. The downstream face of the spillway has two steps. The spillway is flanked upstream by concrete training walls.

A 16-inch diameter cast iron reservoir drain is located near the left end of the spillway. Discharge from the drain is manually operated by a worm gear mechanism connected to a gate valve located downstream of the spillway.

The downstream channel of the spillway is a natural streambed consisting of gravel and boulders. Flow from the reservoir drain empties into the channel.

b. Location

The dam is located on Pascack Brook, a tributary of Hackensack River and the Hudson River, approximately 200 feet from the intersection of Suzanne Drive and Vincent Road in the northwest section of the Village of Spring Valley.

c. Size Classification

The dam is 8 feet high and impounds approximately 36.4 acre-feet. Therefore, the dam is in the "small" size category (less than 40 feet in height).

d. Hazard Classification

The dam is classified as high hazard due to several homes located 500 feet downstream from the dam and its location within the Village of Spring Valley.

e. Ownership

Lake Suzanne Dam is owned by Mr. Morton Ellish, 4910 North Travellers, Palm Lane, Tamarao, Florida, Telephone No. (305) 278-5600.

f. Purpose of Dam

The impoundment provided by the dam is for recreational purposes.

g. Design and Construction History

Original design and construction records are not available. The date when the dam was built is unknown. From visual inspection of the dam, it appears that the spillway was widened to increase the discharge capacity and both spillway training walls were repaired. No records are available for the spillway widening and training wall repairs.

h. Normal Operating Procedures

Lake level is maintained at the crest of the spillway, depending upon the inflow into the lake. At present, the outflow from the lake is over the spillway only. The operating condition of the reservoir drain could not be determined because the owner or owner's representative was not present at the time of the inspection.

1.3 PERTINENT DATA

a. Drainage Area (sq. mi.)	1.48
b. Discharge at Dam	
Maximum Known Flood at Site	Unknown
Ungated Spillway at Maximum Pool, cfs	130

c.	Elevation (feet USGS Datum)	
	Top of Dam	481.0
	Spillway Crest	479.4
d.	Reservoir	
	Length of Normal Pool, Feet	700
	Surface Area of Maximum Pool, Acres	12
	Surface Area of Minimum Pool, Acres	8
e.	Storage, Acre-Feet	
	Spillway Crest	36.4
	Top of Dam	52.4
f.	Dam	
	Type	Earth
	Length	50 feet (estimated)
	Height	8 feet (estimated)
	Crest Width	Varies from 10 to 30 feet (estimated)
	Side Slopes	
	Upstream:	1V:4H (estimated)
	Downstream:	1V:5H (estimated)
g.	Spillway	
	Type	Uncontrolled Concrete
	Crest Width	24 feet
h.	Reservoir Drain	
	Type	16-Inch Cast Iron
	Control	Manually Operated Gate Valve

SECTION 2 - ENGINEERING DATA

2.1 GEOLOGY

Lake Suzanne is located in the Triassic Lowland physiographic province of New York State. This province includes a sedimentary rock sequence, the Brunswick Formation, overlying the Palisade diabase, both of the Newark group. The Brunswick Formation consists of sandstone, red shale conglomerate and limestone conglomerate. Drainage in the area is to the south and generally controlled by north-south joints.

2.2 SUBSURFACE INVESTIGATIONS

No subsurface investigation data could be located for the dam. However, there were three borings performed at the dam during Pascack Brook improvement studies in 1974. The location and the logs of borings are shown on the drawings prepared by William H. Youngblood Associates, Consulting Engineers and Surveyors, Monsey, N.Y., and are given in Appendix A. The borings indicate that the local soil is dense glacial till consisting mostly of fine to medium sand with varying proportions of gravel and silt.

2.3 DESIGN RECORDS

There are no design data, construction drawings or design memoranda available for the project features.

2.4 CONSTRUCTION RECORDS

There are no construction records available for the original dam and subsequent repairs.

2.5 OPERATION RECORDS

There are no records for operation of the reservoir kept by the owner. There are no records available of rainfall and operation of the gate.

2.6 EVALUATION OF DATA

Existing information was made available by the owner (by telephone), the New York State Department of Environmental Conservation and William H. Youngblood Associates, Consulting Engineers and Surveyors, Monsey, N.Y.

The information obtained from available data and the visual inspection is considered adequate for this Phase I inspection and evaluation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of Lake Suzanne Dam was made on Thursday, 26 July 1980. At the time of the inspection, the owner or owner's representative was not present. The weather was sunny and temperature ranged between 80-85°F. Rainfall occurred in the area the previous night. At the time of the inspection, the reservoir level was at spillway crest (El. 479.4).

b. Embankment

The left abutment and the downstream toe of the embankment could not be accurately located because of flat topography, heavy vegetation and ground cover. However, from available information, the length of the embankment is estimated to be about 50 feet; the upstream and downstream slopes are about 1 vertical and 4 horizontal and 1 vertical and 5 horizontal, respectively. The embankment appears generally to be in good condition except in the vicinity of the spillway-embankment contact, where the embankment fill downstream of the left spillway training wall has been eroded apparently as a result of overtopping. A portion of the eroded area was backfilled with a mass concrete blanket immediately downstream of the training wall leaving the remaining portion unrepaired. In addition, subsequent overtopping or runoff has eroded a 3 foot wide, 3 foot deep gully between the embankment and the concrete blanket (See Photograph 6).

The horizontal and vertical alignments of the crest are generally good. The crest is heavily covered with vegetation including trees, saplings, bushes and ground cover.

The upstream slope above reservoir level is in fair condition. The slope is covered with vegetation including trees, saplings and bushes.

The downstream slope of the embankment, which could not be accurately determined, appears to be in good condition. The slope is covered with vegetation including trees, saplings, bushes and heavy ground cover. No seepage was observed.

c. Spillway

The concrete spillway which is located on the right side of the embankment, appears to be in generally good condition. It appears that in order to increase the capacity of the spillway, portions of the training walls at both ends have been removed. The sill in these portions is irregular and is about 0.5 to 1 inch lower than the remainder of the crest. At the time of the inspection, flow was over these portions (See Photograph 4). There is some debris collected at the crest.

The downstream stepped face is in good condition, except at several locations where it is spalled (See Photograph 4). The left and right upstream training walls appear to be in fair condition. The entire upstream face of the right wall above the reservoir level is spalled. The top and downstream faces of the wall above the ground surface were repaired by capping with rough, finished concrete. The entire upstream face of the left training wall above the reservoir level is spalled.

The condition of the downstream face of the wall could not be determined because it is covered by the mass concrete blanket.

There is a wooden planked access bridge which spans the spillway and the eroded area.

d. Appurtenant Structures

The reservoir drain is rusted and appears that it has not been operated for many years. It is reported by the owner (telephone conversation) that the drain is in operating condition. However, the gate was not operated because the owner or the owner's representative was not present during the inspection.

e. Downstream Channel

The channel immediately downstream from the spillway is a natural bed consisting of gravel and boulders. There is minor vegetation and debris in the channel. There is some vegetation including large trees on the banks, however, these will not impede discharges from the spillway drain.

f. Abutments

The left abutment of the dam could not be accurately located due to flat topography, heavy vegetation and ground cover. No seepage was observed at the left or right abutments. At the right abutment-spillway contact there is a shallow gully caused by surface runoff from the roadway and adjacent areas (See Photograph 7).

g. Reservoir Area

In the vicinity of the dam, there was no evidence of sedimentation, sloughing, potentially unstable slopes, or other unusual conditions which would adversely affect the dam.

3.2 EVALUATION OF OBSERVATIONS

Visual observations made during the course of the investigation reveal several deficiencies which should be corrected before further deterioration leads to a hazardous condition. The deficiencies and recommended measures to improve these are as follows:

1. The eroded area of the embankment, downstream of the left spillway training wall, should be backfilled to the level of the embankment crest.

2. The reservoir drain should be returned to operating condition.

3. Divert the surface runoff at the right abutment away from the spillway by means of a drainage ditch. Also backfill the gully to the level of the right abutment.

4. Remove brush and trees from the crest, embankment slopes, and from the downstream channel. Provide a program of periodic cutting and mowing of the embankment surfaces and the downstream channel.

5. The debris from the downstream channel and at the spillway crest should be removed and hauled away. Provide a program of periodic inspection and removal.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The aforementioned emergency action plan should be maintained and updated periodically during the life of the structure.

SECTION 4 - OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

There are no formal operation procedures for the project. The discharges from the reservoir are uncontrolled.

4.2 MAINTENANCE OF DAM

There is no operation and maintenance manual for the dam. The maintenance of the dam is inadequate as evidenced by the condition of the reservoir drain, erosion of the embankment downstream of the left training wall and heavy vegetation on the embankment slopes and crest.

4.3 WARNING SYSTEM IN EFFECT

There is no warning system in effect or in preparation.

4.4 EVALUATION

The operation and maintenance of Lake Suzanne is considered inadequate as noted in Section 3, "Visual Inspection".

SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

Lake Suzanne Dam is located in the northwest section of the Village of Spring Valley, Rockland County, New York, Hydrologic Unit Code 02030103. The watershed contributing to the reservoir is 1.48 square miles, varying in relief from a lake elevation of 480 to about 700 feet MSL. Land cover is approximately 30 percent woods and orchards and 70 percent urban and suburban.

5.2 ANALYSIS CRITERIA

The analysis of Lake Suzanne Dam was performed using the U.S. Army Corps of Engineers HEC-1 DB computer program (Ref. 1). The Probable Maximum Precipitation (PMF) was taken from Hydrometeorological Report No. 33 (Ref. 4) and distributed by the standard EM 1110-2-1411 method (Ref. 6). A unit hydrograph was developed using the Snyder method, and coefficient values of C_t = 2.7 and C_p = 0.703. The loss rates assumed were an initial loss of 2 inches and a constant loss rate of 0.05 inches per hour, and resulted in an excess rainfall of 22.33 inches in 72 hours with a total loss of 3.02 inches, and a PMF peak inflow of 3207 cfs.

5.3 SPILLWAY CAPACITY

The spillway is 24 feet in length with a crest width of about 2 feet at El 479.4, 1.6 feet below the top of the dam. The computed maximum discharge capacity of the spillway is 130 cfs.

5.4 RESERVOIR CAPACITY

The normal capacity of Lake Suzanne is reported to be 36.4 acre-feet. Surcharge storage between El 479.4 (spillway crest elevation) and the top of the dam, El 481, is 16 acre-feet which is equivalent to 0.2 inches of runoff over the entire basin. Maximum capacity of the reservoir is 52.4 acre-feet.

5.5 FLOODS OF RECORD

There are no records of floods available.

5.6 OVERTOPPING POTENTIAL

The potential of the dam being overtopped was investigated on the basis of the spillway capacity and the available

surcharge to meet the computed design flood inflows. Analysis indicates the spillway does not have sufficient capacity for one-half the Probable Maximum Flood (PMF), and overtopping would occur for all storm events exceeding 4 percent of the PMF.

The PMF, routed through the lake resulted in a peak outflow of 3182 cfs and a corresponding surface elevation of 484.31, 3.31 feet over the dam. One-half PMF routed through the lake resulted in a peak outflow of 1591 cfs and a corresponding surface elevation of 483.43, 2.43 feet over the dam.

5.7 EVALUATION

The dam does not have sufficient spillway capacity to pass either the PMF or one-half the PMF without overtopping of the dam. The overtopping could cause the failure of the dam, thus significantly increasing the hazard to loss of life downstream. Therefore, the spillway is assessed as being "seriously inadequate" and the dam is assessed as unsafe, non emergency.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation

Visual observation did not indicate any serious structural problems with the dam. The observed erosion of embankment fill at the spillway contact are not detrimental to the dam's stability or safety at the present time.

b. Design and Construction Data

There are no design computations or other data pertaining to the structural stability of the dam available. There are two drawings prepared as part of the Pascack Brook improvement studies by William H. Youngblood Associates, Consulting Engineers and Surveyors, Monsey, New York. The drawings show the topography of the dam site and subsurface explorations.

c. Stability Analysis

Since there are no contract drawings or documents available showing the full geometry and the extent of the spillway section, the primary source of structural and subsurface information used in the stability analysis is as follows:

1. The crest and downstream face surface geometry of the exposed spillway was measured during the inspection using approximate methods (See sketch of the spillway section in Appendix A).

2. Other geometry of the non-exposed spillway structure and subsurface information was obtained from available data prepared by William H. Youngblood Associates.

The following table shows the results of the structural stability analysis of the spillway section. The computation for the analysis is given in Appendix E.

	Loading Condition	Location of Resultant	Sliding F.S. (See Appendix E)
a.	Normal loading condition, reservoir level at spillway crest, no ice load	1.3 feet outside middle third	0.95
b.	Normal loading condition, reservoir level at spillway crest, with ice load	15 feet outside middle third	0.27
c.	Unusual loading: flood level equal to 1/2 PMF at gravity section	3.5 feet outside middle half	0.35

Loading Condition	Location of Resultant	Sliding F.S. (See Appendix E)
d. Extreme loading: flood level equal to PMF at the gravity section	8.06 feet outside middle half	0.28
e. Unusual loading: reservoir level at spillway crest, and earthquake forces	1.25 feet outside middle half	0.86

The results of the structural analysis indicates that the stability of the spillway section against overturning and sliding are inadequate for all loading cases.

Since there is a lack of information regarding the exact geometry of the spillway, foundation conditions and the extent and magnitude of the uplift pressure under the spillway, the structural stability analysis could not be accurately assessed with any reliability. It is therefore recommended that in conjunction with the hydraulic/hydrologic studies, a more detailed structural stability analysis be performed. Field investigations should be carried out to obtain additional information regarding the uplift pressure within and under the base of the spillway; the quality of the foundation; the geometry and extent of the spillway structure; and the condition of the non-exposed concrete. The information should then be incorporated into a more detailed structural stability evaluation.

d. Operating Records
There are no records of the regulating gate operation.

e. Post-Construction Changes
There are no recorded post-construction changes.

f. Seismic Stability
The dam is located in Seismic Zone 1 in accordance with Phase I recommended guidelines. However, based on the past earthquake experience in the area, the New York State Geological Survey considers the area to be in Seismic Zone 2. Based on this assessment, the dam is considered to be in Seismic Zone 2. The results of the seismic stability are described in Section 6.1c.

SECTION 7 - ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

Examination of available documents and a visual inspection of the dam and the appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial action.

Using the Corps of Engineers screening criteria for review of spillway adequacy, it has been determined that the dam would be overtopped for all storms exceeding approximately 4 percent of the PMF. The overtopping of the dam could cause the erosion of both abutments and the downstream face of the dam, particularly in the vicinity of the spillway-embankment contact resulting in dam failure, thus significantly increasing the hazard to loss of life downstream. The spillway is therefore adjudged as "seriously inadequate" and the dam is assessed as unsafe, non-emergency.

The classification of "unsafe" applied to a dam because of a "seriously inadequate" spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations, there appears to be a serious deficiency in spillway capacity so that if a severe storm were to occur, overtopping and failure of the dam would take place, significantly increasing the hazard to loss of life downstream from the dam.

The results of the stability analysis indicates that the stability of the spillway against overturning and sliding are inadequate for all loading cases.

b. Adequacy of Information

The information and data available were adequate for performance of this investigation, except as noted in Section 6.1c.

c. Need for Additional Investigations

Since the spillway is considered to be "seriously inadequate", additional hydrologic/hydraulic investigations are required to more accurately determine the site specific characteristics of the watershed. After the in-depth hydrologic/hydraulic investigations have been completed, remedial measures must be initiated to provide spillway capacity sufficient to discharge the outflow from the 1/2 PMF event. In addition, an investigation of the structural stability of the spillway portion of the dam is required.

d. Urgency

The additional hydrologic/hydraulic investigations and the stability investigation which are required must be initiated within 3 months from the date of notification. Within 12 months of notification, remedial measures as a result of these investigations must be initiated, with completion of these measures during the following year. In the interim, develop an emergency action plan for the notification of downstream residents and proper governmental authorities in the event of overtopping, and provide round-the-clock surveillance of the dam during periods of extreme runoff. The other problem areas listed below must be corrected within 1 year from notification.

7.2 RECOMMENDED MEASURES

1. Backfill the eroded area of the embankment downstream of the left spillway training wall (spillway-embankment contact).

2. The reservoir drain should be returned to operational condition.

3. Backfill the gully at the right abutment and divert surface runoff from pavement and adjacent areas away from the right abutment.

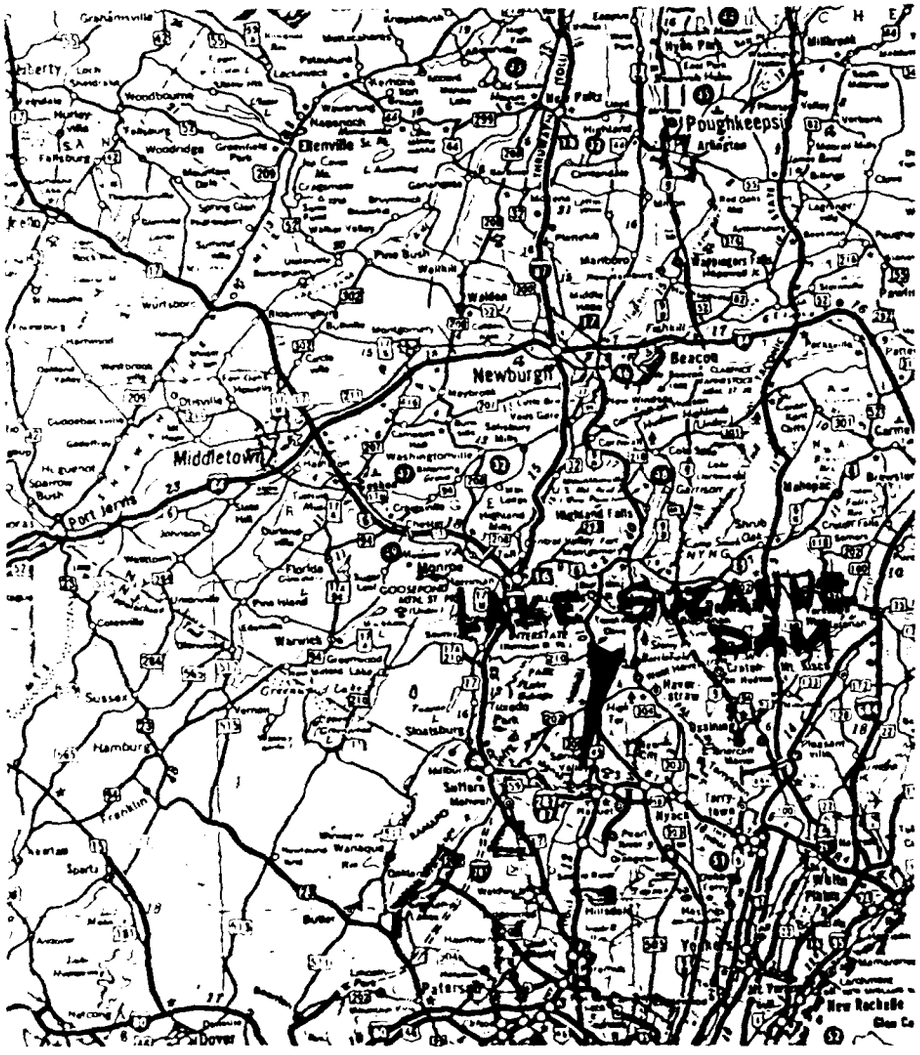
4. Remove all brush and trees from the crest, embankment slopes and downstream channel. Provide a program of periodic inspection and cutting and mowing of the embankment surfaces and the downstream channel.

5. Remove debris from the downstream channel and at the spillway crest. Provide a program of periodic inspection and removal.

6. Provide a program of periodic inspection and maintenance of the dam and appurtenances including yearly operation and lubrication of the reservoir drain system. Document this information for future reference. The aforementioned emergency action plan should be maintained and updated periodically during the life of the structure.

DRAWINGS

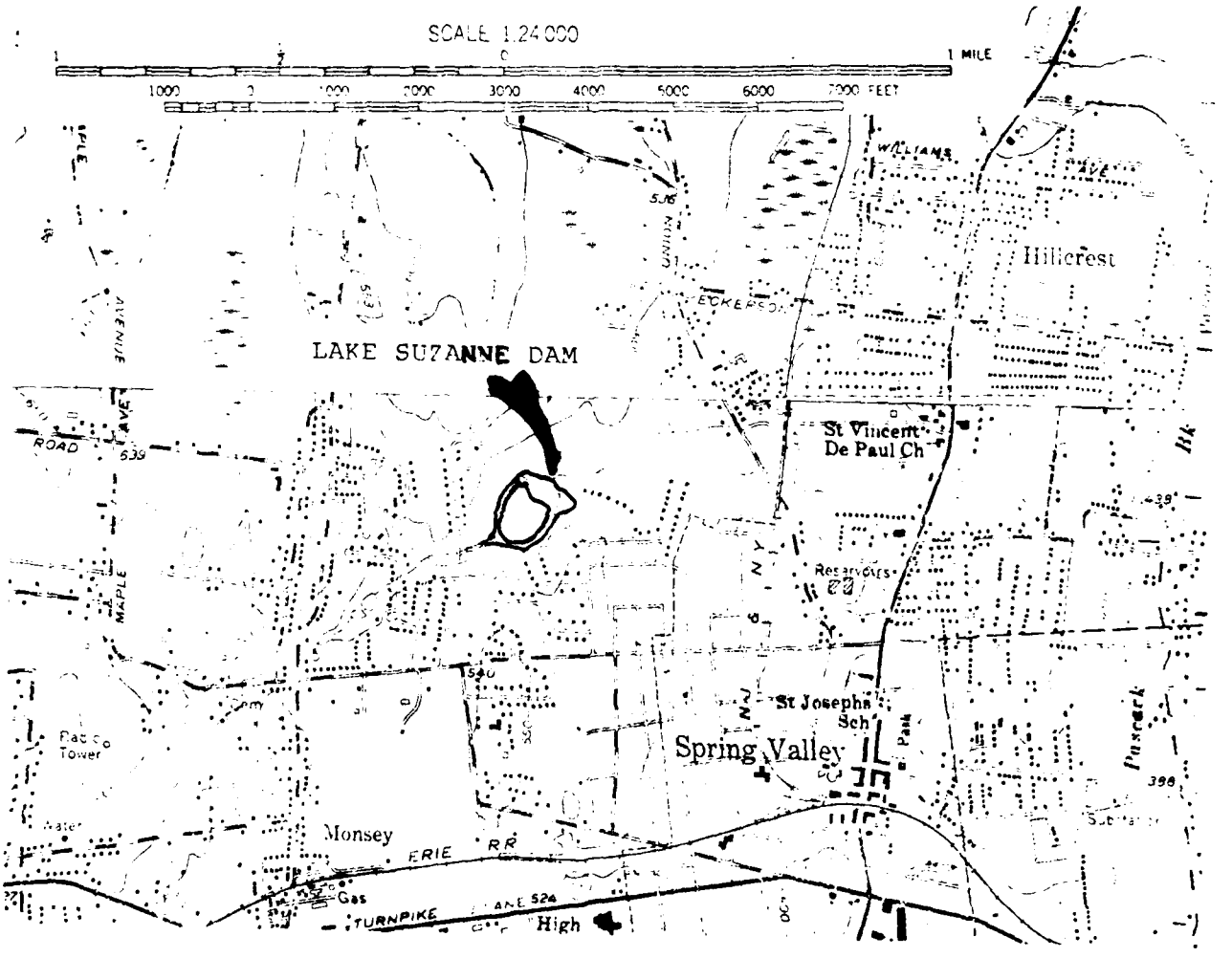
APPENDIX A



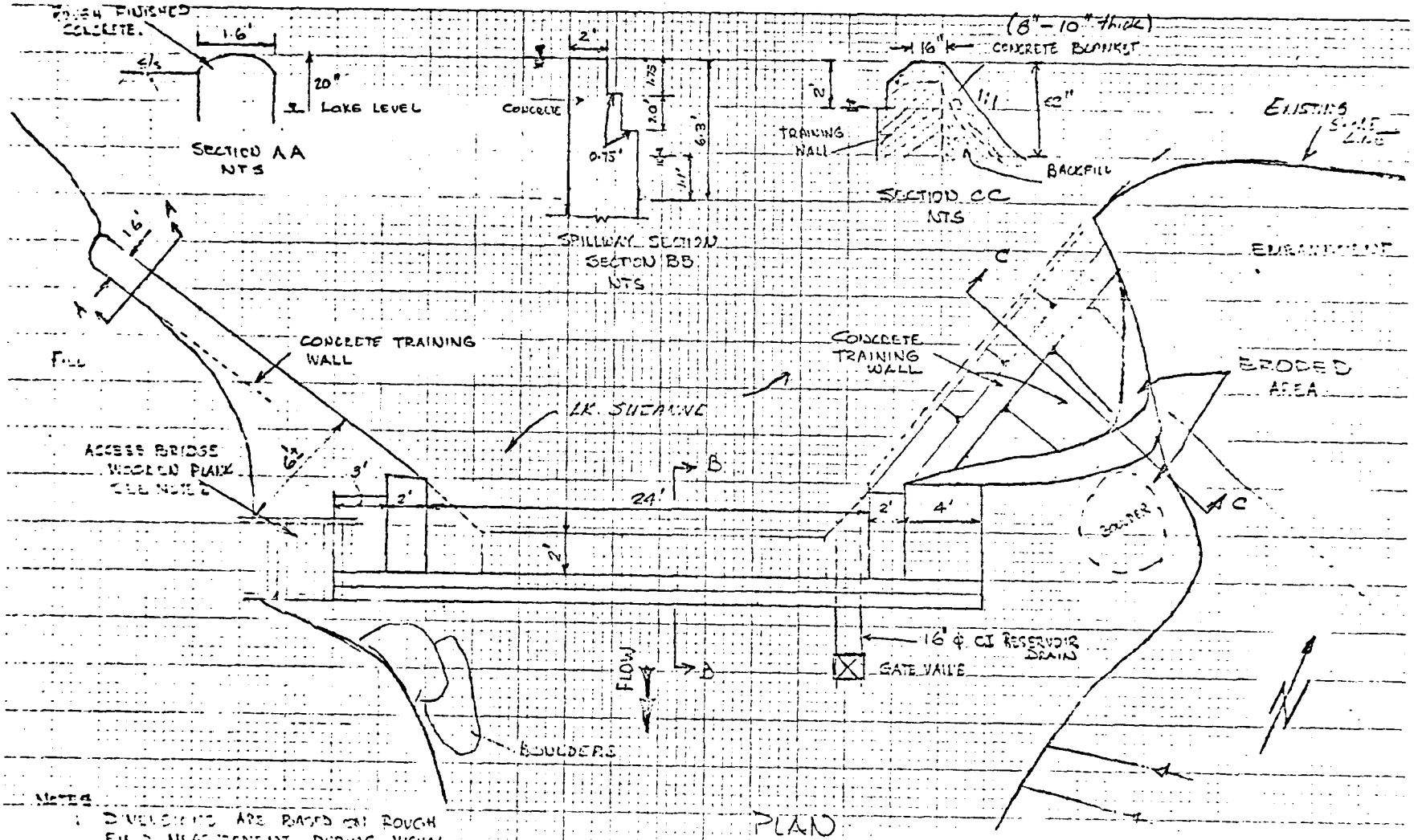
SCALE: 1 inch = 11.2 Miles

VICINITY MAP
LAKE SUZANNE DAM

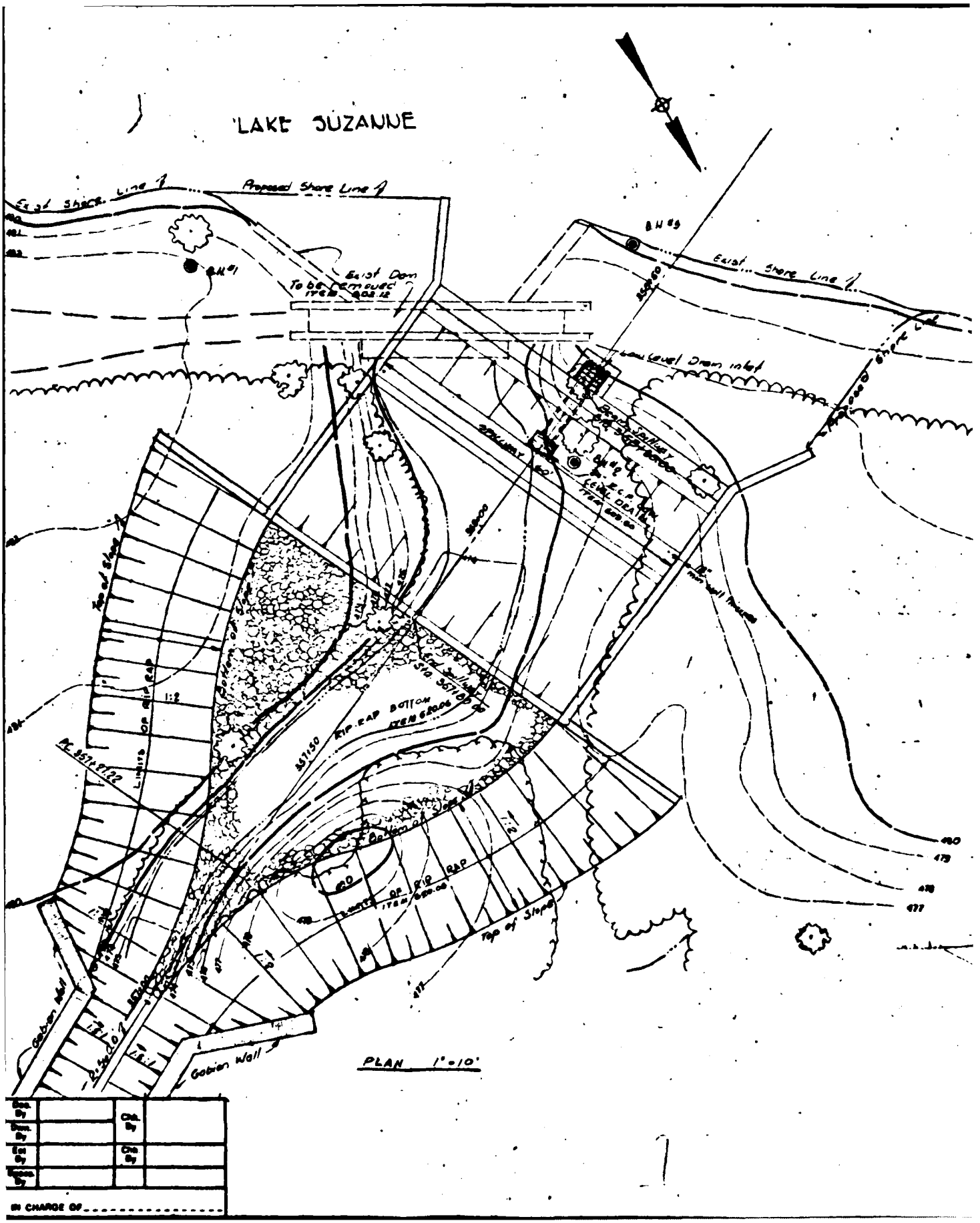
PARK RIDGE QUAD
New Jersey - New York



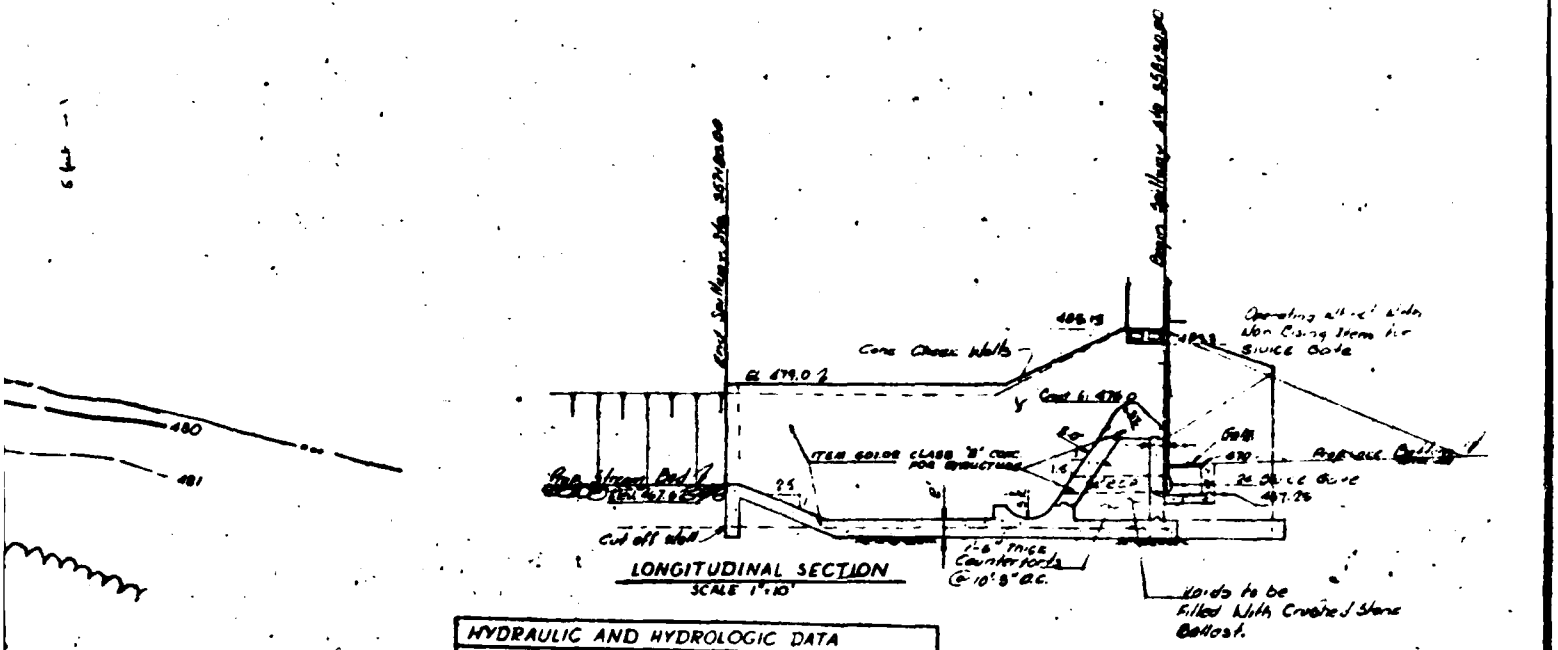
TOPOGRAPHIC MAP
LAKE SUZANNE DAM



LK. SUZANNE DAM
SPILLWAY - PLAN & SECTIONS


LAKE SUZANNE
Exist Shore Line
Proposed Shore Line
BH 91
Exist Dam
To be removed
BH 89
Exist Shore Line
Low Level Drain inlet
Spillway
Top of Slope
Gabion Wall
Rip-rap Bottom
Top of Slope
Gabion Wall
PLAN 1"=10'
IN CHARGE OF

project no.	year	sheet no	total sheets



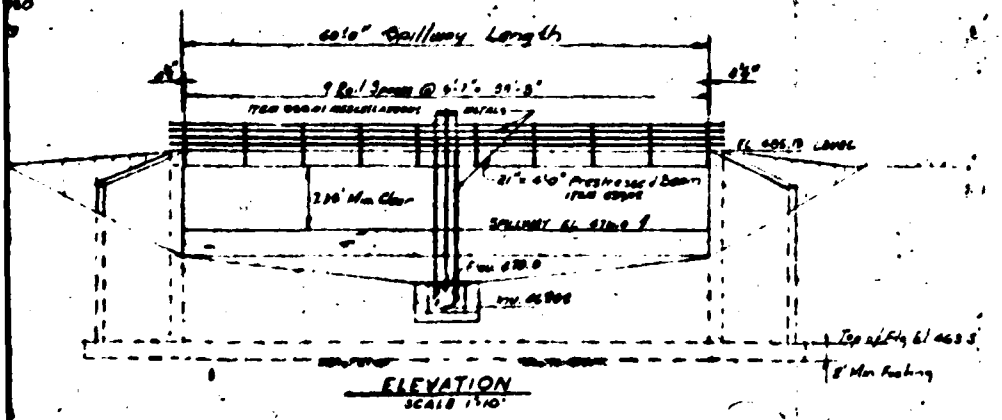
LONGITUDINAL SECTION
SCALE 1"=10'

HYDRAULIC AND HYDROLOGIC DATA

Drainage Area	1.5 Sq. Miles
Surface Area of Pond (Normal Stage)	81 Acres
Storage Capacity (Normal Stage)	364 Acre Feet
Design Flood = 426B C.F.S. = 40% of Max Probable Flood	
Service Spillway Capacity	426BC.F.S. @ d= 6.3'
Storage Capacity @ Design High Water	365 Acre Feet

GENERAL NOTES

1. MATERIAL AND CONSTRUCTION SPECIFICATIONS STANDARD SPECIFICATIONS CONSTRUCTION AND MATERIALS OF THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION DESIGN AND CONSTRUCTION DIVISION, DATED JANUARY 2 1973 WITH CURRENT ADDITIONS AND MODIFICATIONS.
2. ALLOWABLE STRESSES
   CONCRETE: f'_c = 3000 PSI - ULTIMATE STRENGTH
   f_c = 1200 PSI - ALLOWABLE STRESS
   V = 80 PSI MAX. ANCHORED BARS
   WHERE V = 0.15 f'_c = 450 PSI SHEAR KEYS
   STEEL f_s = 20,000 PSI
3. LOADS
   SUBMERGED EARTH EQUIV FLUID PRESSURE = 100 lbs/ft³
   DRY EARTH EQUIV FLUID PRESSURE = 30 lbs/ft³
   WATER = 64 lbs/ft³
   ICE PRESSURE @ SPILLWAY CREST = 5000 lbs/L.F.
4. FOR DESIGN PURPOSES THE FOUNDATION PRESSURE DOES NOT EXCEED 8 TONS PER SQUARE FOOT
5. LIVE LOAD WALK WAY STRUCTURE = 60 #/S.F.
6. ALL STEEL POSTS, RAILS, FRAMES, GRATES ETC TO BE GALVANIZED IN ACCORDANCE WITH NYS DOT STANDARD SPECIFICATION 719-01 GALVANIZED COATINGS AND REPAIR METHODS NO SPECIFIC PAYMENT WILL BE MADE FOR THE GALVANIZED COATING THE COST OF WHICH SHALL BE INCLUDED IN THE UNIT PRICE OF THE ITEMS SO COATED.



ELEVATION
SCALE 1"=10'

Rockland County Drainage Agency
ROCKLAND COUNTY, NEW YORK

BROOK IMPROVEMENTS
PASCACK BROOK - STREAM NO (NJ 8)

GENERAL PLAN AND PROFILE
LAKE SUZANNE DAM AND SPILLWAY
REACH A

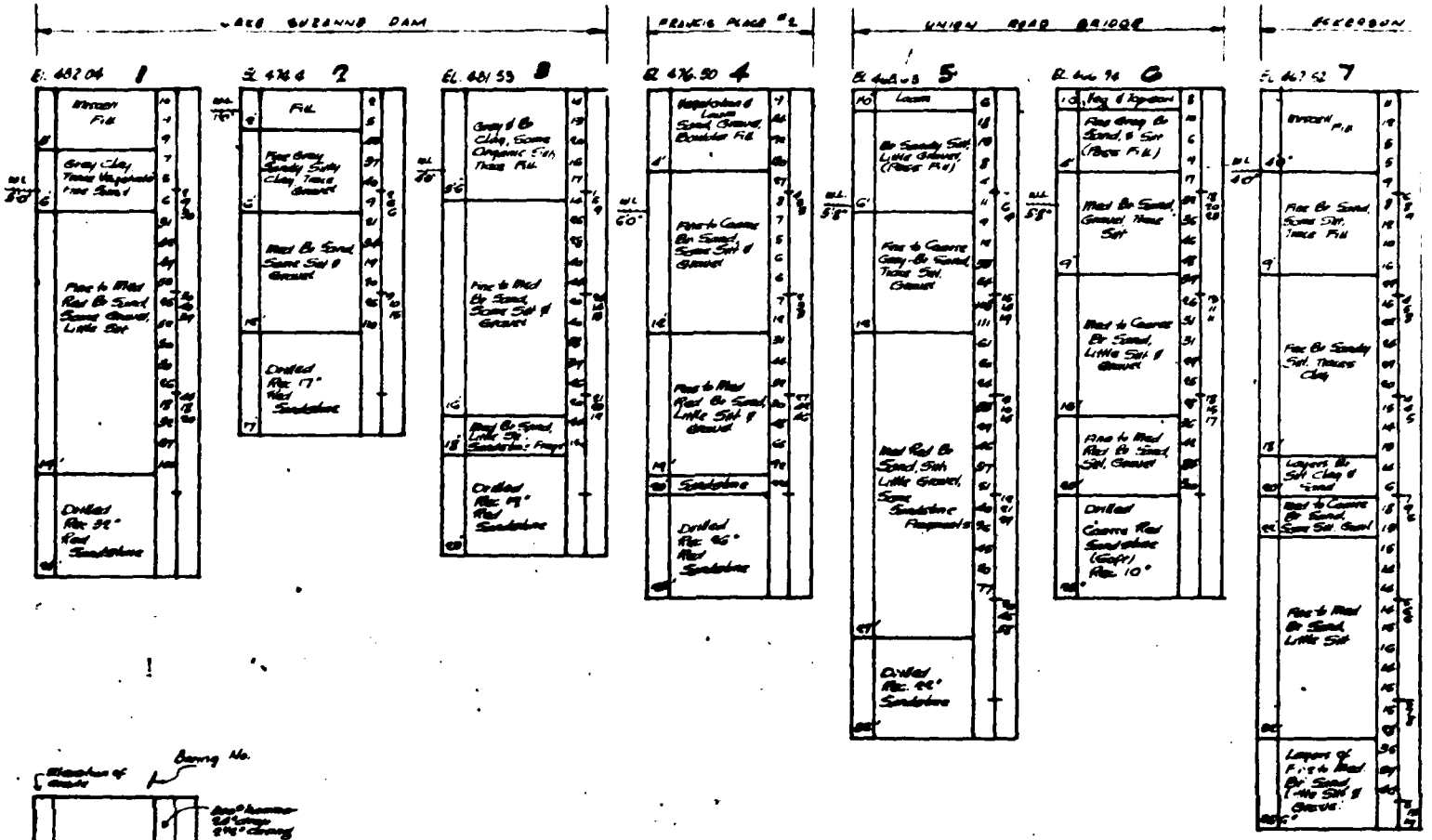
William Youngblood Associates
Consulting Engineers and Surveyors
344 Route 59, Monsey N.Y. 10952
Route 208 Monroe N.Y. 10950

Date 76
Scale AS SHOWN

33/50

Prepared & Recommended By WILLIAM H. YOUNGBLOOD P.E. & L.S. #50178

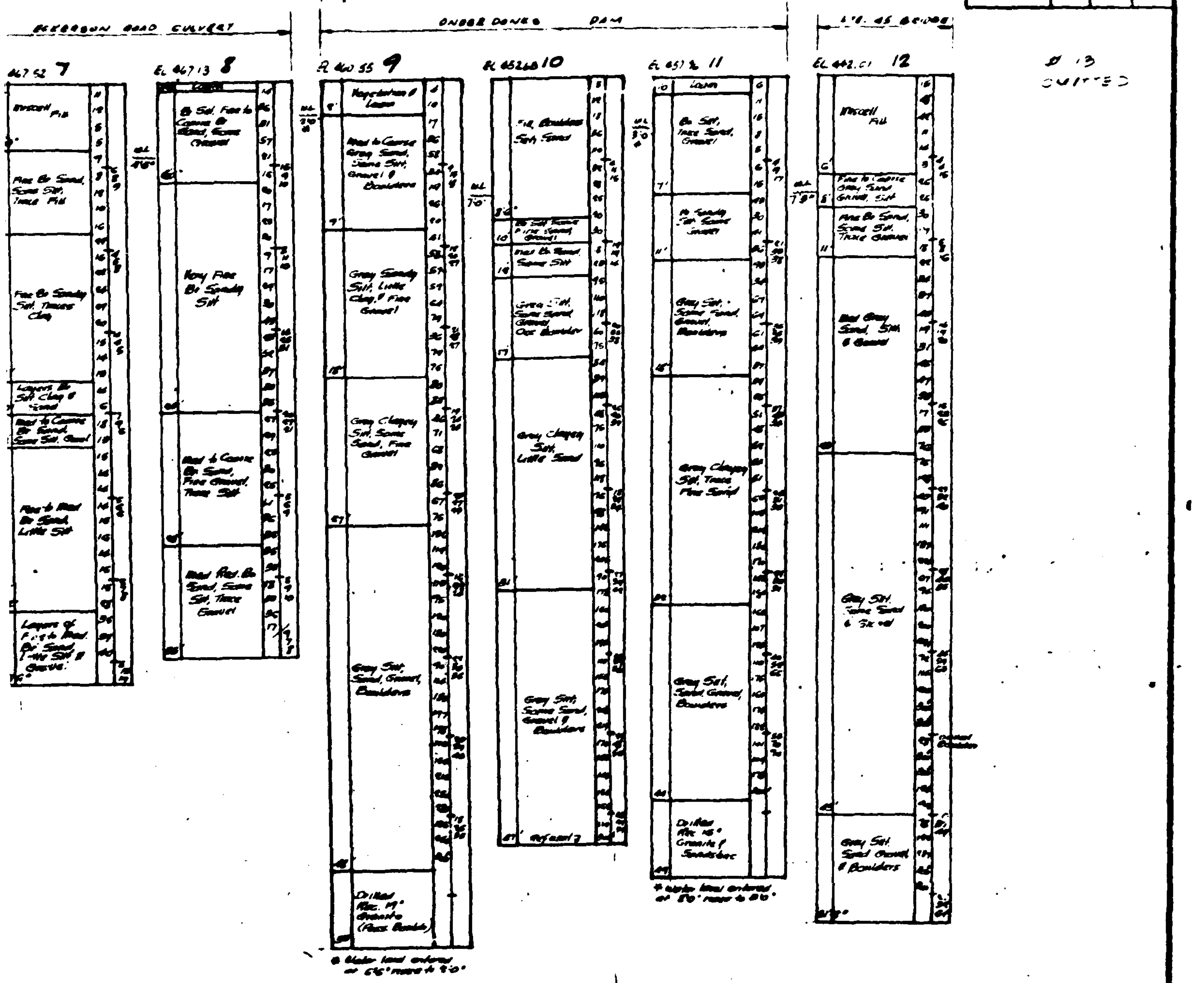
Revision	By	CHK	Date



DES. BY		CHK. BY	
DET. BY			
CHK. BY		CHK. BY	
APPD. BY			

IN CHARGE OF

Prepared



Prepared & Recommended By .... WILLIAM H. YOUNGBLOOD N.Y.S. P.E.& L.S. 60179

Rockland County Drainage Agency

ROCKLAND COUNTY, NEW YORK

BROOK IMPROVEMENTS

PASCACK BROOK - STREAM NO (HJS)

BORINGS 1 THRU 12

William Youngblood Associates

Consulting Engineers and Surveyors

244 Route 59, Monsey N.Y. 10952

Route 17 M, Monroe N.Y. 10950

Date ________

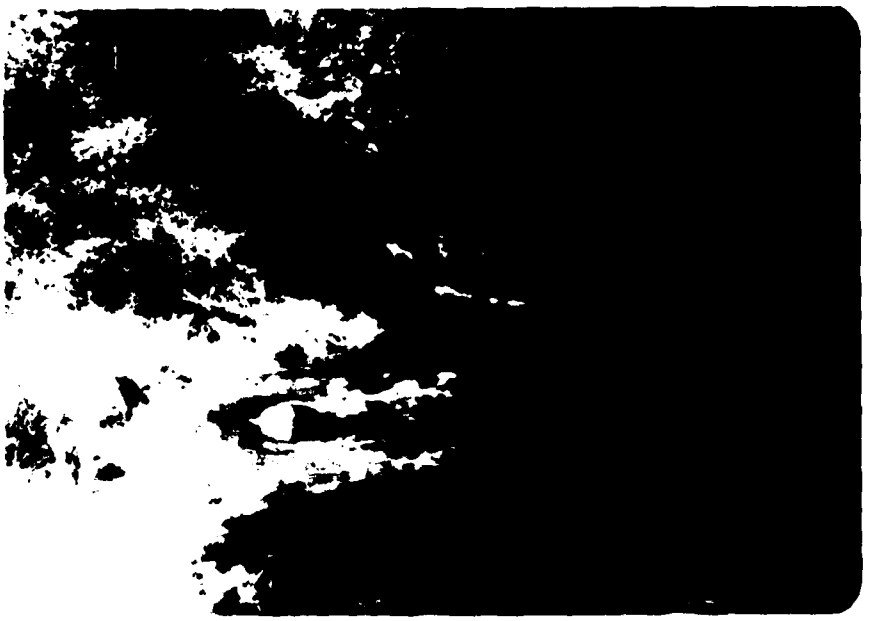
Scale ________

Revision	By	Ck'd	Date

PHOTOGRAPHS

APPENDIX B

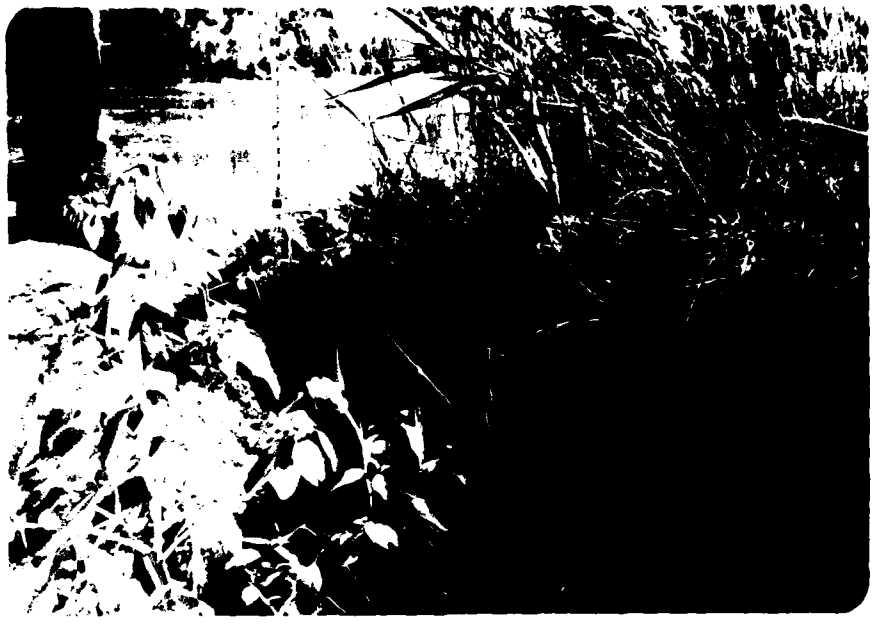
2. UPSTREAM VIEW OF DAM



3. VIEW OF DOWNSTREAM CHANNEL. NOTE VEGETATION.

4. VIEW OF SPILLWAY. NOTE SPALLING OF CONCRETE AT TRAINING WALL AND FACE OF SPILLWAY AND MINOR DEBRIS COLLECTED AT CREST.

5. VIEW OF REGULATING CONTROL FOR RESERVOIR DRAIN.



6. VIEW AT CONTACT BETWEEN DOWNSTREAM FACE OF LEFT SPILLWAY TRAINING WALL AND THE EMBANKMENT. NOTE EROSION OF EMBANKMENT FILL.

7. VIEW OF RIGHT ABUTMENT. NOTE GULLY CAUSED BY SURFACE RUNOFF.

VISUAL INSPECTION CHECKLIST

APPENDIX C

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam LAKE SUFFERN

Fed. I.D. # 760 DEC Dam No. 1960-0179

River Basin Lower Hudson

Location: Town SPRING VALLEY County ROCKLAND

Stream Name PASCACK BROOK

Tributary of HACKENSACK RIVER

Latitude (N) 41° 29' 15" Longitude (W) 73° 56' 30"

Type of Dam EARTH WITH CONCRETE SPILLWAY

Hazard Category HIGH

Date(s) of Inspection JUNE 24, 1980

Weather Conditions SUNNY TEMP 80°-85°F RAINED PREVIOUS NIGHT

Reservoir Level at Time of Inspection EL 479.4

b. Inspection Personnel HARRY G. SEGGOS AND JOSEPH P. WU

c. Persons Contacted (Including Address & Phone No.) OWNER OF DAM REPRESENTATIVE NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION Address and Phone No. AS GIVEN BELOW

d. History:

Date Constructed UNKNOWN Date(s) Reconstructed UNKNOWN

Designer UNKNOWN

Constructed By UNKNOWN

Owner NO. MEDICAL CENTER, 4910 NORTH TRAVELERS, PALM LOT TAMARAC, FLORIDA TEL NO. (305) 722-5500.

Embankment

a. Characteristics

(1) Embankment Material _____

(2) Cutoff Type Unknown

(3) Impervious Core Unknown

(4) Internal Drainage System None

(5) Miscellaneous The length and size of the embankment could not be reasonably determined because of slight sloughing, heavy vegetation, and ground cover.

b. Crest

(1) Vertical Alignment Above the normal operating pool of the Shellmound Lake the embankment has eroded due to wave action.

(2) Horizontal Alignment Good

(3) Surface Cracks None observed.

(4) Miscellaneous Overgrown grass. Roadway and trail ruts.

c. Upstream Slope

(1) Slope (Estimate) (V:H) 1:4 (from available drawings)

(2) Undesirable Growth or Debris, Animal Burrows Overgrown

(3) Sloughing, Subsidence or Depressions None observed

(4) Slope Protection Natural ground cover

(5) Surface Cracks or Movement at Toe Not observable

d. Downstream Slope From available drawing

(1) Slope (Estimate - V:H) IV:5(H) ; Toe of the slope could not be located because of flat topography, heavy vegetation and ground cover

(2) Undesirable Growth or Debris, Animal Burrows Heavy vegetation including evergreen trees, brush and ground cover

(3) Sloughing, Subsidence or Depressions None at the spillway exit (see e abutment contact) could not be observed because of heavy vegetation, brush and ground cover

(4) Surface Cracks or Movement at Toe Not observable because of heavy vegetation, brush and ground cover

(5) Seepage None observed.

(6) External Drainage System (Ditches, Trenches; Blanket) No channel.

(7) Condition Around Outlet Structure Fair (spillway)

(8) Seepage Beyond Toe None observed, in the area 50 feet downstream from the toe line.

e. Abutments - Embankment Contact

Left embankment contact is natural ground but could not be determined because of height of grass and heavy vegetation and ground cover. Right embankment contact is with spillway.

(1) Erosion at Contact: left -- None observed. Tie Rock Contact -- The embankment fill downstream of right spillway training wall is eroded [illegible] backfilling with [illegible] behind the downstream face of the wall. ~~(2) Seepage Along Contact~~ Heavy flow is still noted and downstream of the wall

(2) Seepage Along Contact: None observed.

3) Drainage System

a. Description of System: None

b. Condition of System

c. Discharge from Drainage System

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.)

None

5) Reservoir

a. Slopes In vicinity of the dam are in generally stable condition

b. Sedimentation No evidence of excessive sedimentation observed; No floating debris

c. Unusual Conditions Which Affect Dam None

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) Several homes along Mt. Rock and Village of Stoney Valley

b. Seepage, Unusual Growth None observed.

c. Evidence of Movement Beyond Toe of Dam None observed.

d. Condition of Downstream Channel Minor debris and vegetation obstruction in good condition.

7) Spillway(s) (Including Discharge Conveyance Channel)

24 Foot wide Concrete Spillway. Downstream channel of Dam is also spillway channel

a. General

b. Condition of ~~Service~~ Spillway Spillway is good condition except the upstream training walls which are in fair condition. The concrete apron of the spillway at the junction is spalled. The entire upstream face of the both training walls are spalled.

c. Condition of Auxiliary Spillway None.

d. Condition of Discharge Conveyance Channel Unlined in the immediate channel for the dam is good except minor debris and vegetation.

8) Reservoir Drain/Outlet

Type: Pipe ✓ Conduit _____ Other _____

Material: Concrete _____ Metal ✓ Other _____

Size: 16" Length Unknown

Invert Elevations: Entrance Unknown Exit Unknown

Physical Condition (Describe): Unobservable ✓

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: _____

Means of Control: Gate ✓ Valve _____ Uncontrolled _____.

Operation: Operable _____ Inoperable _____ Other Unknown.

Present Condition (Describe): The operating condition of the gate could not be determined because owner representative was not present at the time of inspection. The gate is rusted.

9) Structural — Spillway

a. Concrete Surfaces Spillway downstream face: Upstream face at crest location; Upstream training walls - both walls upstream face, spillway and downstream face at crest looked

b. Structural Cracking None at spillway face and crest training wall. A crack observed along the top of left training wall near the embankment contact.

c. Movement - Horizontal & Vertical Alignment (Settlement) None observed

d. Junctions with Abutments or Embankments Right abutment is in good condition. The spillway and embankment contact is sealed. (See comments & photograph 7e)

e. Drains - Foundation, Joint, Face None observed.

f. Water Passages, Conduits, Sluices

Discharge channel unobstructed.

g. Seepage or Leakage

None observed except at outlet channel - Spillway flow and tail water flow the left bank upstream of the downstream face and the spillway/foundation contact.

h. Joints - Construction, etc. [illegible]

i. Foundation [illegible]

j. Abutments [illegible]

k. Control Gates None

l. Approach & Outlet Channels [illegible]

m. Energy Dissipators (Plunge Pool, etc.) None

n. Intake Structures [illegible]

o. Stability [illegible]

p. Miscellaneous

HYDROLOGIC DATA AND COMPUTATIONS

APPENDIX D

TAMS

Job No. 1551-09 Sheet 1 of 5

Project

Subject LAKE SUZANNE DAM INSPECTION
HYDROLOGIC / HYDRAULIC COMPUTATIONS

Date June 30 19

By BLC

Ch'k. by

SPILLWAY 24.0' x 1.6' - broad crested with 2.5' wide.

"NEW" overflow Section 50.0'

Reservoir

Area 9.1 acres

Volume 36.4 acre feet.

DRAINAGE AREA 1.48 SQ MILES

L = 5" = 1.89 miles Use C_t = 2.7 C_p = 0.703.

L_{CA} = 2" = 0.75 miles

$T_p = 2.7(L L_{CA})^{0.3} = 3.0$ hours

24 hour 200 Sq Mile INDEX P.M.P. = 22 inches (Ref 1)

24 HOUR POINT RAINFALL: (% of INDEX PMP)

6 hr.	12 hr.	24 hr	48 hr
111	121	133.	144

Assume: 2 inch initial loss

0.05 in constant loss.

Impervious area 0.05% ~ 50 acres (reservoir, roads, houses etc)

TAMS

Job No. 1551-09 Sheet 2 of 5

Project LAKE SUZANNE DAM INSPECTION Date JULY 21, 19

Subject HYDROLOGIC / HYDRAULIC COMPUTATIONS By D.C.C.

SPILLWAY Rating. Ch'k. by

LENGTH 24.0' NON overflow Section = 50.0'

Use C = 2.70.

EL.	Q_3	Q_2	Q_2	Q_T
479.4	0	0	0	0
480.	30	0	0	30
481.	130	0	0	130
483.	440	380	0	820
485.	800	1080	2490	4430
490.	2240	3640	16300	22170

Q_2 - discharge over non-overflow Section. L = 50

Q_3 - discharge over earth embankment L = 226'

TAMS

Job No. 1521-09 Sheet 3 of 5

Project

Subject LAKE SUZANNE DAM INSPECTION
HYDROLOGIC / HYDRAULIC COMPUTATIONS

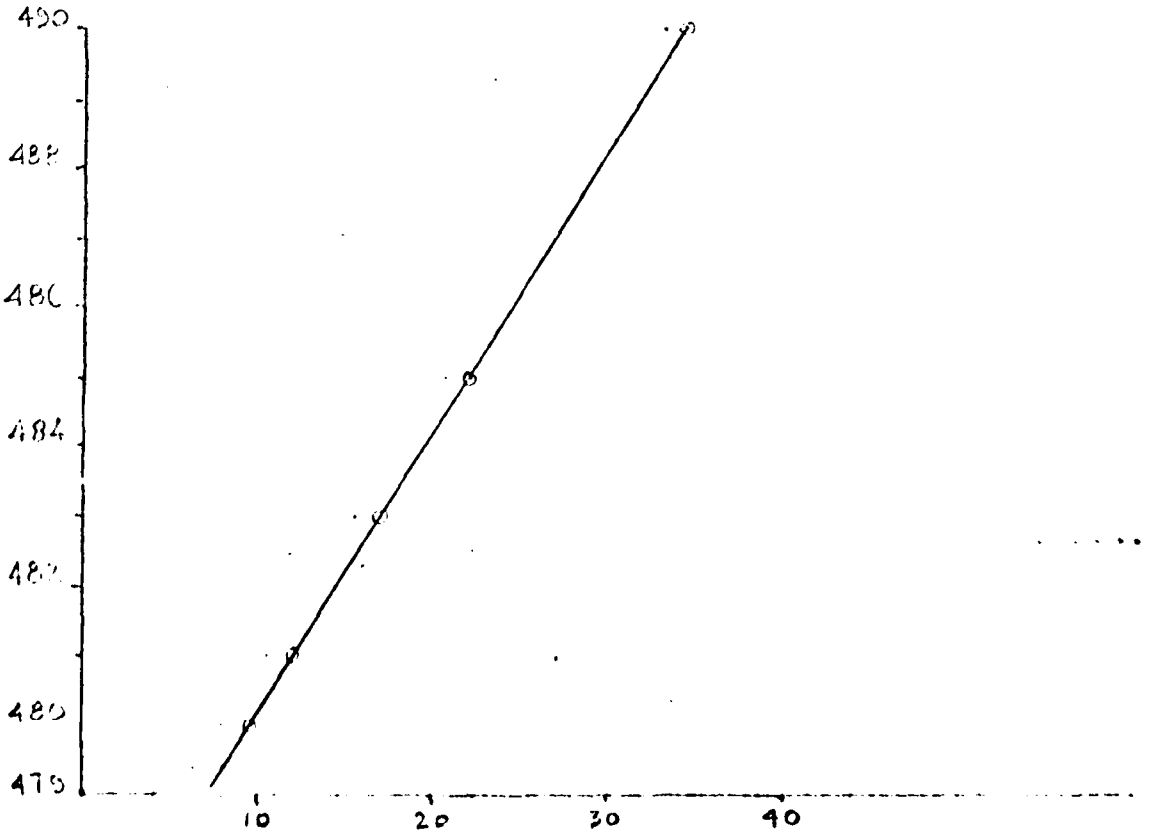
Date AUG 1 19[illegible]

By DLC

Ch'k. by

ELEVATION / STORAGE

EL.	ΔH	AREA	MEAN AREA	ΔVOLUME	STORAGE
479.4		8.0			36.4
	0.6		8.75	5.25	
480.		9.5			41.7
	1.0		10.75	10.75	
481		12.0			52.4
	2.0		14.5	29.0	
483		17.0			81.4
	2.0		19.5	39.0	
485		22.0			120.4
	5.0		28.15	140.75	
490.		34.3			261.2



TAMS

Job No. _____ Sheet 4 of 5

Project _____ Date July 21, 1978

Subject LAKE SUZANNE HYDROLOGIC/HYDRAULIC COMPUTATIONS By D. L. C.

Ch'k. by _____

ELEVATION	STORAGE AC FT	DISCHARGE CFS.
479.4	36.4	0
480	41.7	30
481	52.4	130
483	81.4	820
485	120.4	4430
490	261.2	28200.

14.9 Ac Ft of Surcharge Storage equivalent to approx 0.2 inches of R/O over basin.

TAMS

Job No. 1551-09 Sheet 5 of 5
Project LAKE SUZANNE DAM INSPECTION Date [illegible]
Subject D/S Valley Cross Sections. By [illegible]
Ch'k. by

	Distance	Elevation
Station 500		
Slope = 0.01	2900	500
	4550	490
	4800	480
	4985	470
	5000	468
	5015	470
	5400	480
	5800	500
Station 2500		
Slope = 0.003	4100	475
	4400	470
	4985	465
	5000	462
	5015	465
	5200	470
	5350	475
	5500	480

Aug. 1, 1980.

LAKE SUZANNE DAM
SPRAY & INSPECTION AUG 1980
REGIONAL MAXIMUM FLOOD ANALYSIS

1551 CP

BASIN RUNOFF

ROUTED FLOWS THROUGH LAKE SUZANNE

CHANNEL ROUTING BELOW DAM STA 0+00

CHANNEL ROUTING BELOW DAM STA 25+00

(1)

LAKE SUZANNE DAM
BUDGET & INSPECTION AUG 1980
PROBABLE MAXIMUM FLOOD ANALYSIS

1551 09

JOB SPECIFICATION

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

SUB-AREA RUNOFF COMPUTATION

BASIN RUNOFF

HYDROGRAPH DATA

PRECIP DATA

LOSS DATA

UNIT HYDROGRAPH DATA

RECESSION DATA

(5)

END-OF-PERIOD FLOW

HYDRO	HOUR	PERIOD	RAIN	EXCS	LOSS	COMP Q	HOUR	PERIOD	RAIN	EXCS	LOSS	COMP Q
1	1.00	1	.01	.00	.01	1.	1.00	1	.01	.00	.01	1.
	1.01	2	.01	.00	.01	1.	1.01	2	.01	.00	.01	1.
	1.02	3	.01	.00	.01	1.	1.02	3	.01	.00	.01	1.
	1.03	4	.01	.00	.01	1.	1.03	4	.01	.00	.01	1.
	1.04	5	.01	.00	.01	1.	1.04	5	.01	.00	.01	1.
	1.05	6	.01	.00	.01	1.	1.05	6	.01	.00	.01	1.
	1.06	7	.01	.00	.01	1.	1.06	7	.01	.00	.01	1.
	1.07	8	.01	.00	.01	1.	1.07	8	.01	.00	.01	1.
	1.08	9	.01	.00	.01	1.	1.08	9	.01	.00	.01	1.
	1.09	10	.01	.00	.01	1.	1.09	10	.01	.00	.01	1.
	1.10	11	.01	.00	.01	1.	1.10	11	.01	.00	.01	1.
	1.11	12	.01	.00	.01	1.	1.11	12	.01	.00	.01	1.
	1.12	13	.01	.00	.01	1.	1.12	13	.01	.00	.01	1.
	1.13	14	.01	.00	.01	1.	1.13	14	.01	.00	.01	1.
	1.14	15	.01	.00	.01	1.	1.14	15	.01	.00	.01	1.
	1.15	16	.01	.00	.01	1.	1.15	16	.01	.00	.01	1.
	1.16	17	.01	.00	.01	1.	1.16	17	.01	.00	.01	1.
	1.17	18	.01	.00	.01	1.	1.17	18	.01	.00	.01	1.
	1.18	19	.01	.00	.01	1.	1.18	19	.01	.00	.01	1.
	1.19	20	.01	.00	.01	1.	1.19	20	.01	.00	.01	1.
	1.20	21	.01	.00	.01	1.	1.20	21	.01	.00	.01	1.
	1.21	22	.01	.00	.01	1.	1.21	22	.01	.00	.01	1.
	1.22	23	.01	.00	.01	1.	1.22	23	.01	.00	.01	1.
	1.23	24	.01	.00	.01	1.	1.23	24	.01	.00	.01	1.
	1.24	25	.01	.00	.01	1.	1.24	25	.01	.00	.01	1.
	1.25	26	.01	.00	.01	1.	1.25	26	.01	.00	.01	1.
	1.26	27	.01	.00	.01	1.	1.26	27	.01	.00	.01	1.
	1.27	28	.01	.00	.01	1.	1.27	28	.01	.00	.01	1.
	1.28	29	.01	.00	.01	1.	1.28	29	.01	.00	.01	1.
	1.29	30	.01	.00	.01	1.	1.29	30	.01	.00	.01	1.
	1.30	31	.01	.00	.01	1.	1.30	31	.01	.00	.01	1.
	1.31	32	.01	.00	.01	1.	1.31	32	.01	.00	.01	1.
	1.32	33	.01	.00	.01	1.	1.32	33	.01	.00	.01	1.
	1.33	34	.01	.00	.01	1.	1.33	34	.01	.00	.01	1.
	1.34	35	.01	.00	.01	1.	1.34	35	.01	.00	.01	1.
	1.35	36	.01	.00	.01	1.	1.35	36	.01	.00	.01	1.
	1.36	37	.01	.00	.01	1.	1.36	37	.01	.00	.01	1.
	1.37	38	.01	.00	.01	1.	1.37	38	.01	.00	.01	1.
	1.38	39	.01	.00	.01	1.	1.38	39	.01	.00	.01	1.
	1.39	40	.01	.00	.01	1.	1.39	40	.01	.00	.01	1.
	1.40	41	.01	.00	.01	1.	1.40	41	.01	.00	.01	1.
	1.41	42	.01	.00	.01	1.	1.41	42	.01	.00	.01	1.
	1.42	43	.01	.00	.01	1.	1.42	43	.01	.00	.01	1.
	1.43	44	.01	.00	.01	1.	1.43	44	.01	.00	.01	1.
	1.44	45	.01	.00	.01	1.	1.44	45	.01	.00	.01	1.
	1.45	46	.01	.00	.01	1.	1.45	46	.01	.00	.01	1.
	1.46	47	.01	.00	.01	1.	1.46	47	.01	.00	.01	1.
	1.47	48	.01	.00	.01	1.	1.47	48	.01	.00	.01	1.
	1.48	49	.01	.00	.01	1.	1.48	49	.01	.00	.01	1.
	1.49	50	.01	.00	.01	1.	1.49	50	.01	.00	.01	1.
	1.50	51	.01	.00	.01	1.	1.50	51	.01	.00	.01	1.
	1.51	52	.01	.00	.01	1.	1.51	52	.01	.00	.01	1.
	1.52	53	.01	.00	.01	1.	1.52	53	.01	.00	.01	1.
	1.53	54	.01	.00	.01	1.	1.53	54	.01	.00	.01	1.
	1.54	55	.01	.00	.01	1.	1.54	55	.01	.00	.01	1.
	1.55	56	.01	.00	.01	1.	1.55	56	.01	.00	.01	1.
	1.56	57	.01	.00	.01	1.	1.56	57	.01	.00	.01	1.
	1.57	58	.01	.00	.01	1.	1.57	58	.01	.00	.01	1.
	1.58	59	.01	.00	.01	1.	1.58	59	.01	.00	.01	1.
	1.59	60	.01	.00	.01	1.	1.59	60	.01	.00	.01	1.
	2.00	61	.01	.00	.01	1.	2.00	61	.01	.00	.01	1.
	2.01	62	.01	.00	.01	1.	2.01	62	.01	.00	.01	1.
	2.02	63	.01	.00	.01	1.	2.02	63	.01	.00	.01	1.
	2.03	64	.01	.00	.01	1.	2.03	64	.01	.00	.01	1.
	2.04	65	.01	.00	.01	1.	2.04	65	.01	.00	.01	1.
	2.05	66	.01	.00	.01	1.	2.05	66	.01	.00	.01	1.
	2.06	67	.01	.00	.01	1.	2.06	67	.01	.00	.01	1.
	2.07	68	.01	.00	.01	1.	2.07	68	.01	.00	.01	1.
	2.08	69	.01	.00	.01	1.	2.08	69	.01	.00	.01	1.
	2.09	70	.01	.00	.01	1.	2.09	70	.01	.00	.01	1.
	2.10	71	.01	.00	.01	1.	2.10	71	.01	.00	.01	1.
	2.11	72	.01	.00	.01	1.	2.11	72	.01	.00	.01	1.
	2.12	73	.01	.00	.01	1.	2.12	73	.01	.00	.01	1.
	2.13	74	.01	.00	.01	1.	2.13	74	.01	.00	.01	1.
	2.14	75	.01	.00	.01	1.	2.14	75	.01	.00	.01	1.
	2.15	76	.01	.00	.01	1.	2.15	76	.01	.00	.01	1.
	2.16	77	.01	.00	.01	1.	2.16	77	.01	.00	.01	1.
	2.17	78	.01	.00	.01	1.	2.17	78	.01	.00	.01	1.
	2.18	79	.01	.00	.01	1.	2.18	79	.01	.00	.01	1.
	2.19	80	.01	.00	.01	1.	2.19	80	.01	.00	.01	1.
	2.20	81	.01	.00	.01	1.	2.20	81	.01	.00	.01	1.
	2.21	82	.01	.00	.01	1.	2.21	82	.01	.00	.01	1.
	2.22	83	.01	.00	.01	1.	2.22	83	.01	.00	.01	1.
	2.23	84	.01	.00	.01	1.	2.23	84	.01	.00	.01	1.
	2.24	85	.01	.00	.01	1.	2.24	85	.01	.00	.01	1.
	2.25	86	.01	.00	.01	1.	2.25	86	.01	.00	.01	1.
	2.26	87	.01	.00	.01	1.	2.26	87	.01	.00	.01	1.
	2.27	88	.01	.00	.01	1.	2.27	88	.01	.00	.01	1.
	2.28	89	.01	.00	.01	1.	2.28	89	.01	.00	.01	1.
	2.29	90	.01	.00	.01	1.	2.29	90	.01	.00	.01	1.
	2.30	91	.01	.00	.01	1.	2.30	91	.01	.00	.01	1.
	2.31	92	.01	.00	.01	1.	2.31	92	.01	.00	.01	1.
	2.32	93	.01	.00	.01	1.	2.32	93	.01	.00	.01	1.
	2.33	94	.01	.00	.01	1.	2.33	94	.01	.00	.01	1.
	2.34	95	.01	.00	.01	1.	2.34	95	.01	.00	.01	1.
	2.35	96	.01	.00	.01	1.	2.35	96	.01	.00	.01	1.
	2.36	97	.01	.00	.01	1.	2.36	97	.01	.00	.01	1.
	2.37	98	.01	.00	.01	1.	2.37	98	.01	.00	.01	1.
	2.38	99	.01	.00	.01	1.	2.38	99	.01	.00	.01	1.
	2.39	100	.01	.00	.01	1.	2.39	100	.01	.00	.01	1.
	2.40	101	.01	.00	.01	1.	2.40	101	.01	.00	.01	1.
	2.41	102	.01	.00	.01	1.	2.41	102	.01	.00	.01	1.

SUM 25.34 22.33 3.00 45215.
(.444,.35,.27,.24)

PEAK 6-HOUR 24-HOUR 72-HOUR TOTAL VOLUME
CFS 3227. 2105. 947. 534. 45401.
CMS 91. 60. 27. 15. 1285.
INCHES .93 .82 .35 .20 1.66
MM 23.72 20.82 8.89 5.08 42.22
ACRE-FT 7977. 7000. 2989. 1708. 14186.
THOUS CU M 9839. 8634. 3687. 2107. 17501.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	
2.	2.	2.	1.	1.	2.	2.	3.	3.	4.	
4.	5.	5.	7.	12.	13.	14.	13.	12.	11.	
6.	7.	7.	6.	6.	5.	5.	5.	4.	4.	
4.	44.	48.	39.	30.	48.	56.	63.	69.	73.	
78.	82.	94.	103.	125.	148.	161.	176.	180.	198.	
235.	241.	289.	277.	291.	517.	710.	947.	1207.	1533.	
1964.	2372.	2671.	3000.	3207.	3154.	2904.	2546.	2175.	1814.	
1515.	1402.	1342.	1271.	1156.	1107.	1033.	963.	899.	839.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3207.	2418.	941.	454.	45401.
CMS	91.	68.	27.	13.	1286.
INCHES		13.20	23.47	23.78	23.78
MM		335.27	601.10	604.02	604.02
AC-FT		1199.	1867.	1874.	1874.
THOUS CU M		1479.	2303.	2314.	2314.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	
1.	1.	1.	1.	1.	1.	1.	1.	2.	2.	
3.	3.	4.	5.	6.	7.	7.	7.	6.	5.	
5.	4.	3.	3.	5.	7.	5.	3.	2.	2.	
2.	8.	9.	14.	19.	24.	28.	32.	34.	36.	
39.	42.	47.	54.	62.	72.	80.	88.	94.	99.	
103.	110.	114.	120.	186.	250.	356.	473.	604.	766.	
971.	1186.	1384.	1533.	1602.	1577.	1452.	1273.	1087.	907.	
758.	730.	691.	636.	578.	553.	516.	482.	449.	419.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1603.	1209.	471.	227.	22701.
CMS	45.	34.	13.	6.	643.
INCHES		7.60	11.83	11.89	11.89
MM		193.01	300.55	302.01	302.01
AC-FT		599.	934.	938.	938.
THOUS CU M		739.	1151.	1157.	1157.

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HYDROGRAPH ROUTING

ROUTED FLOWS THROUGH LAKE SUZANNE

ICSTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

CLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

ISTPS	ISTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	36.	-1

STAGE	479.4	480.00	482.00	485.00	490.00	
FLOW	0.00	30.00	100.00	800.00	4430.00	28000.00

CAPACITY= 36. 42. 52. 81. 120. 261.

ELEVATION= 470. 480. 487. 493. 495. 500.

SPFL	SPWID	COOK	EXPW	ELEVL	COOL	CAREA	EXPL
479.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
481.0	0.0	1.5	50.

STATION 2, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	2.	2.	2.
3.	3.	4.	5.	6.	8.	9.	10.	10.	11.
11.	10.	10.	9.	9.	8.	7.	6.	6.	6.
6.	6.	8.	11.	16.	21.	28.	37.	46.	54.
61.	67.	74.	88.	94.	107.	121.	144.	169.	185.
190.	204.	225.	240.	264.	291.	330.	771.	1097.	1456.
1825.	2260.	2462.	2999.	3182.	3200.	2951.	2645.	2271.	1909.
1621.	1470.	1290.	1224.	1206.	1127.	1052.	981.	915.	854.

STORAGE

36.	36.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	38.	38.	38.	38.	38.	38.
38.	38.	38.	38.	38.	38.	38.	38.	38.	37.
37.	37.	38.	38.	39.	40.	41.	40.	43.	44.
45.	46.	46.	47.	48.	50.	52.	53.	54.	55.
56.	56.	56.	57.	59.	63.	70.	78.	84.	90.
92.	97.	101.	105.	107.	107.	105.	101.	97.	93.
90.	89.	88.	87.	86.	85.	84.	83.	82.	82.

STAGE

479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4
479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4
479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4
479.5	479.5	479.5	479.5	479.5	479.6	479.6	479.6	479.6	479.6
479.6	479.6	479.6	479.6	479.6	479.6	479.5	479.5	479.5	479.5
479.5	479.5	479.5	479.6	479.7	479.8	480.0	480.1	480.2	480.2
480.3	480.4	480.4	480.5	480.6	480.8	480.9	481.0	481.1	481.2
481.2	481.2	481.2	481.3	481.5	481.8	482.2	482.7	483.2	483.4
483.4	483.4	484.0	484.2	484.1	484.3	484.2	484.0	483.8	483.6
483.6	483.4	483.3	483.2	483.2	483.2	483.1	483.1	483.1	483.0

PEAK OUTFLOW IS 3182. AT TIME 42.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3182.	2417.	949.	445.	44304.
CMS	90.	68.	26.	12.	1255.
INCHES		13.19	23.13	25.24	27.24
MM		335.04	586.93	640.82	692.02
AC-FT		4800.	1882.	883.	87911.
THOUS CU M		5922.	2321.	1089.	108411.

STATION 2, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	1.	1.	1.	
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	
1.	2.	2.	3.	3.	4.	4.	3.	3.	5.	
5.	5.	4.	4.	4.	4.	4.	3.	3.	3.	
3.	4.	4.	6.	8.	11.	14.	17.	21.	24.	
27.	29.	34.	39.	45.	52.	60.	69.	79.	82.	
86.	89.	90.	170.	427.	684.	965.	1264.	1578.	1915.	
2264.	2630.	3014.	3000.	3361.	3690.	3491.	3322.	3176.	954.	
817.	777.	739.	693.	639.	593.	555.	518.	484.	451.	

STORAGE

36.	36.	36.	36.	36.	36.	36.	36.	36.	36.
36.	36.	36.	36.	36.	36.	36.	36.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	37.	37.	37.	37.	37.	37.
37.	37.	37.	37.	38.	39.	39.	39.	40.	41.
41.	42.	42.	43.	43.	44.	45.	46.	47.	47.
48.	49.	49.	50.	52.	55.	58.	60.	62.	72.
84.	81.	77.	89.	90.	90.	89.	87.	85.	83.
81.	80.	78.	76.	74.	72.	70.	69.	67.	66.

STAGE

479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4
479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4
479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4	479.4
479.4	479.4	479.4	479.5	479.5	479.5	479.5	479.5	479.5	479.5
479.5	479.5	479.5	479.5	479.5	479.5	479.5	479.5	479.5	479.5
479.5	479.5	479.5	479.5	479.6	479.6	479.7	479.7	479.8	479.9
479.9	480.0	480.0	480.1	480.2	480.2	480.3	480.4	480.5	480.5
480.6	480.7	481.0	480.9	481.0	481.2	481.4	481.7	482.0	482.4
482.7	482.2	482.2	483.4	483.4	483.4	483.4	483.0	483.0	483.1
483.0	482.9	482.7	482.6	482.5	482.3	482.2	482.1	482.0	481.9

PEAK OUTFLOW IS 1541. AT TIME 42.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1541.	1250.	456.	220.	21990.
CMS	45.	34.	13.	6.	623.
INCHES		7.54	11.47	11.52	11.52
MM		191.58	291.26	292.55	292.55
AC-FT		505.	909.	909.	909.
THOUS CU M		734.	1116.	1121.	1121.

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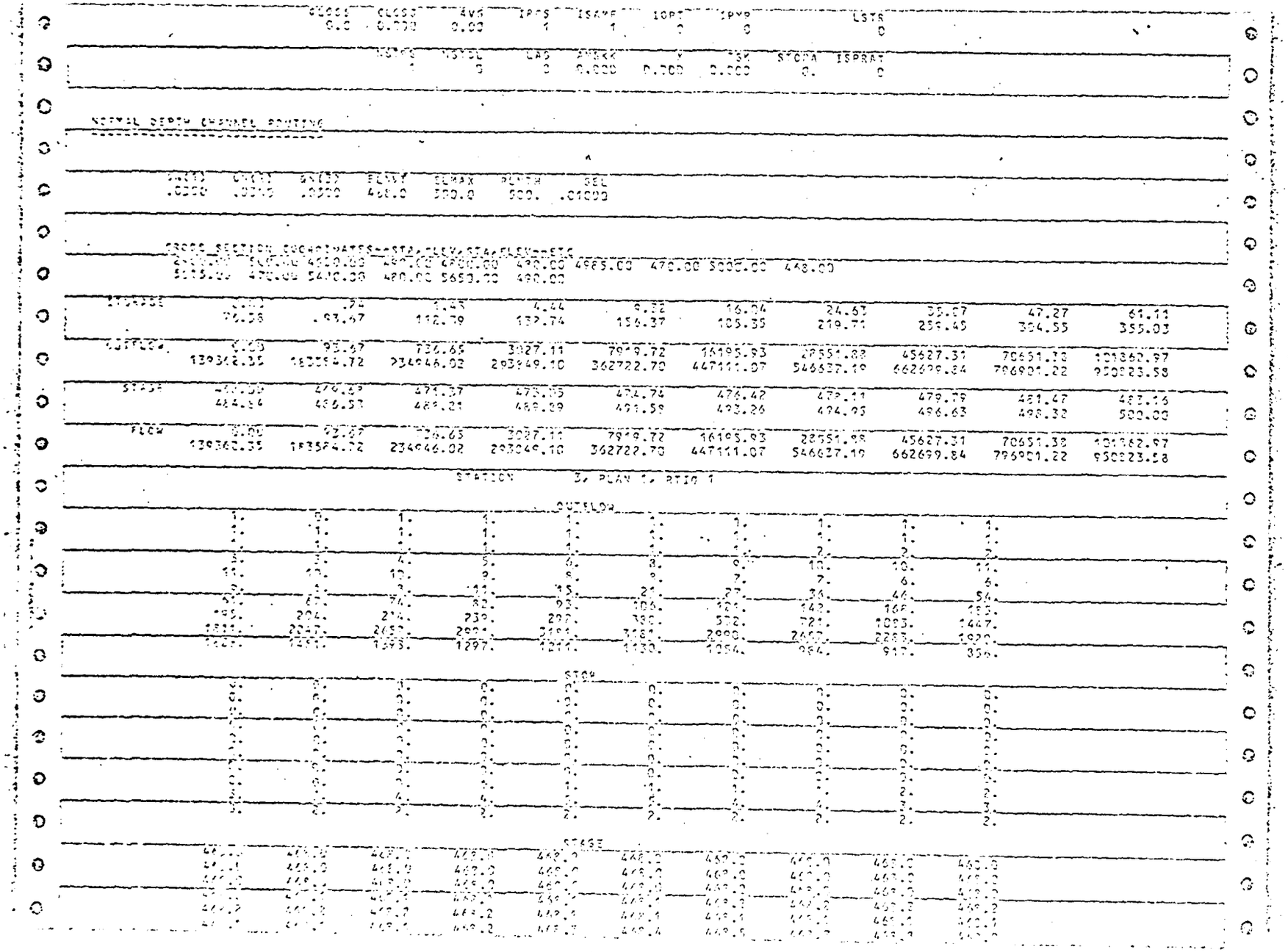
HYDROGRAPH ROUTING

CHANNEL ROUTING BELOW DAM STA 5+00

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA



MAXIMUM STORAGE = 3.

MAXIMUM STAGE IS 472.0

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HYDROGRAPH ROUTING

CHANNEL ROUTING BELOW DAM STA 25+00

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	0	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0500	.0500	.0500	462.0	490.0	2000.	.00300

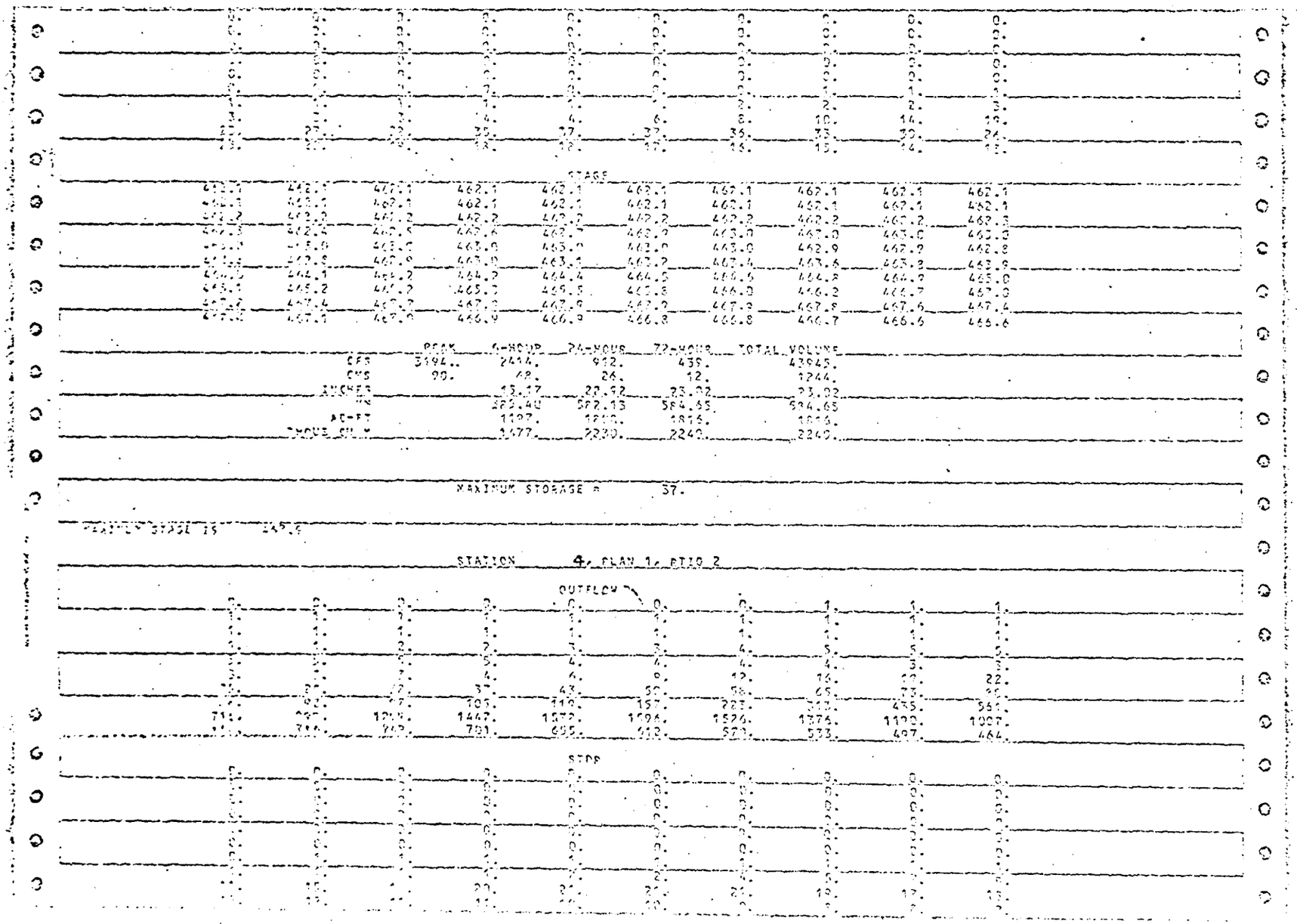
CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 475.00 4400.00 470.00 4953.00 465.00 5000.00 462.00 5015.00 465.00
5200.00 470.00 5350.00 475.00 5500.00 490.00

STORAGE	0.00	.27	.92	1.83	5.36	15.12	31.24	53.69	82.50	117.22
	155.75	197.84	243.46	292.63	345.26	399.72	455.42	512.36	570.53	629.94
OUTFLOW	0.00	7.32	24.49	137.07	318.74	1008.77	2509.64	5070.41	8914.43	14727.41
	22463.19	31837.14	42847.31	55576.52	70692.97	88818.23	108878.98	130760.56	154445.22	179920.43
STAGE	462.00	462.97	463.89	464.84	465.79	466.74	467.69	468.63	469.58	470.53
	471.47	472.42	473.37	474.32	475.26	476.21	477.16	478.11	479.05	480.00
FLOW	0.00	7.32	24.49	137.07	318.74	1008.77	2509.64	5070.41	8914.43	14727.41
	22463.19	31837.14	42847.31	55576.52	70692.97	88818.23	108878.98	130760.56	154445.22	179920.43

STATION 4, PLAN 1, RTIO 1

OUTFLOW

0.	0.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	2.	2.
2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
11.	10.	10.	9.	9.	8.	7.	7.	7.	6.
6.	6.	7.	9.	14.	19.	25.	33.	43.	54.
[illegible]	[illegible]	74.	80.	90.	107.	117.	136.	156.	177.
[illegible]	221.	209.	227.	317.	346.	481.	634.	943.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



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```
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        1.        1.        1.
         1.        1.        1.        1.        1.        1.        2.        2.        2.        3.
         3.        3.        3.        4.        4.        6.        8.       10.       14.       19.
        22.       27.       22.       35.       37.       37.       36.       33.       30.       26.
        23.       20.       20.       18.       17.       17.       16.       15.       14.       13.

                                                  STAGE
      462.1     462.1     462.1     462.1     462.1     462.1     462.1     462.1     462.1     462.1
      462.1     462.1     462.1     462.1     462.1     462.1     462.1     462.1     462.1     462.1
      462.2     462.2     462.2     462.2     462.2     462.2     462.2     462.2     462.2     462.3
      462.3     462.4     462.5     462.6     462.7     462.9     463.0     463.0     463.0     463.0
      463.0     463.0     463.0     463.0     463.0     463.0     463.0     462.9     462.9     462.8
      462.8     462.8     462.9     463.0     463.1     463.2     463.4     463.6     463.8     463.9
      464.0     464.1     464.2     464.3     464.4     464.5     464.6     464.8     464.9     465.0
      465.1     465.2     465.3     465.3     465.5     465.8     466.0     466.2     466.7     467.0
      467.2     467.4     467.7     467.9     467.9     467.9     467.9     467.8     467.6     467.4
      467.2     467.1     467.0     466.9     466.9     466.8     466.8     466.7     466.6     466.6

                          PEAK    6-HOUR    24-HOUR    72-HOUR    TOTAL VOLUME
                CFS      3194.     2414.      912.       439.         43945.
                CMS        90.       68.       26.        12.          1244.
             INCHES                13.17     22.92      23.02          23.02
                 MM               335.40    582.13     584.65         584.65
              AC-FT                1197.     1808.      1816.          1816.
          THOUS CU M               1477.     2230.      2240.          2240.

                                 MAXIMUM STORAGE =       37.

   MAXIMUM STAGE IS       467.9

                                 STATION        4, PLAN 1, RTIO 2

                                                 OUTFLOW
         0.        0.        0.        0.        0.        0.        0.        1.        1.        1.
         1.        1.        1.        1.        1.        1.        1.        1.        1.        1.
         1.        1.        1.        1.        1.        1.        1.        1.        1.        1.
         1.        1.        2.        2.        3.        3.        4.        5.        5.        5.
         3.        3.        3.        5.        4.        4.        4.        4.        3.        3.
         3.        3.        7.        4.        6.        9.       12.       16.       19.       22.
 [illegible]      27.       27.       37.       43.       50.       56.       65.       73. [illegible]
 [illegible]      92.       97.      105.      119.      157.      223.      313.      435.      561.
       711.      997.     1259.     1447.     1572.     1596.     1526.     1376.     1190.     1007.
 [illegible]     316.      962.      701.      695.      612.      573.      533.      497.      464.

                                                  STOR
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
 [illegible] [illegible] [illegible] [illegible] [illegible]  2. [illegible]  5. [illegible] [illegible]
 [illegible]      15. [illegible]      22.       21.       21.       21.       18.       17.       15.
 [illegible]      13. [illegible]      11.       11.       10.        9.        8.        7.        7.
```

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	479.40	479.40	481.00
STORAGE	36.	36.	52.
OUTFLOW	0.	0.	170.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	484.31	3.31	107.	3492.	16.50	42.50	0.00
.50	482.43	1.43	90.	1591.	12.00	42.50	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	3491.	473.1	42.50
.50	1595.	472.0	42.00

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	3484.	467.9	43.00
.50	1596.	467.1	43.00

STABILITY ANALYSIS

APPENDIX E

TAMS

Job No. 1511 Sheet 1 of 12
Project PHASE I INSPECTION Date 8-5-80
Subject LK SUZANNE STABILITY ANALYSIS By JJ
Ch'k. by WSF

Assumptions

1. The unit weight of Concrete is assumed to be 150 lbs/cuft.

2. Ice load of 5000 lbs/sqft acting about 1ft from top of dam (Corps Engn. Criteria)

3 Angle of internal resistance of 'Fill' is assumed to be 35°

4. Dam site is in Seismic Zone 2

LOADING CONDITIONS

CASE I Normal loading; LK. level at Spillway Crest with no ice load

CASE II Normal loading; LK level at Spillway Crest with ice load.

CASE III Unusual loading LK. level at ½ PMF

CASE IV Extreme loading LK level at PMF

CASE V Unusual loading; LK level at Spillway Crest and earthquake forces

TAMS

Job No. 1511 Sheet 2 of 12

Project PHASE I INSPECTION Date 8-5-80

Subject LK. SUZANNE STABILITY ANALYSIS By JP

Ch'k. by

STABILITY CRITERIA:

The stability criteria against overturning and sliding were evaluated as follows.

Overturning - Stability is considered adequate if the resultant of all forces falls within the middle third of the base under the normal loading condition and within middle half of the base under the unusual and extreme loading conditions.

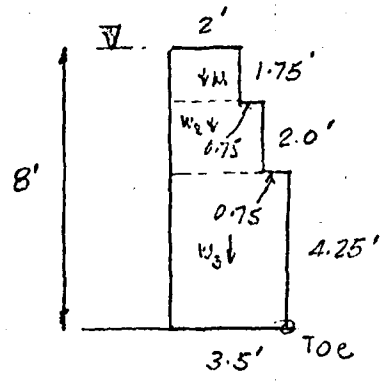
Sliding - Stability along the base of the structure is evaluated using the friction factor of safety (FFS) which is equal to $V \tan\phi / H$, where V is the sum of vertical forces acting on the base, H is the sum of all horizontal forces and $\tan\phi$ is Friction Factor the stability with respect to sliding is considered adequate if the FFS exceeds 1.50 under normal loading conditions, 1.25 under unusual loading conditions and 1.1 under extreme loading conditions.

TAMS

Job No. 1551-
Project PHASE I INSPECTION
Subject LK. SUZANNE – STABILITY ANALYSIS

Sheet 3 of 12
Date 8-5-80
By JP
Ch'k. by

a. Dead Loads



. EM at Toe

		K	Ft	KF
W_1	= 2 X 1.75 X 0.15 =	0.525	X 2.5	= 1.31
W_2	= 2.75 X 2.0 X 0.15 =	0.825	X 2.125	= 1.75
W_3	= 3.5 X 4.25 X 0.15 =	2.23	X 1.75	= 3.90
	F_V	3.58		M_R = 6.96

$\bar{x}$ = 1.94'

	0.525	X 7.125	= 3.74
	0.825	X 5.25	= 4.33
	2.23	X 2.125	= 4.74
F_V	3.58		12.81

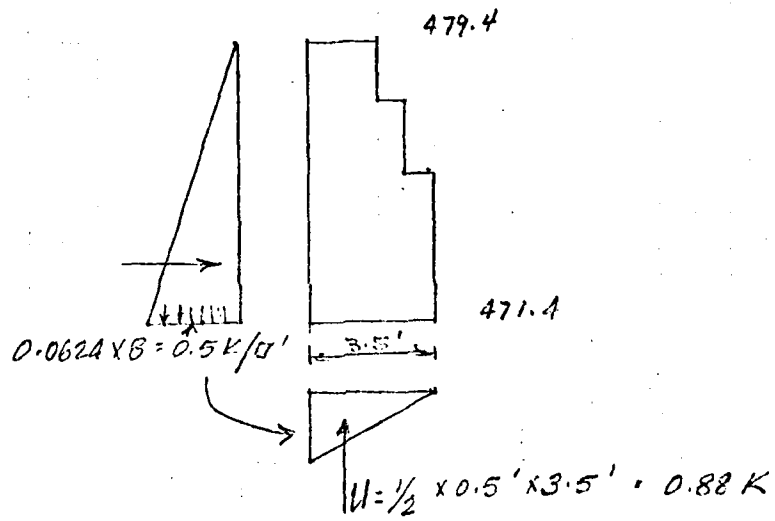
$\bar{y}$ = 3.58'

TAMS

Job No. 1511 Sheet 4 of 12
Project NYS Dam Inspection Date 8-5-80
Subject LK SUTANNE - STABILITY ANALYSIS By JP
Ch'k. by

6 HYDROSTATIC FORCES

Normal loading: WL @ SPILLWAY CREST El. 479.4



ΣM at Toe

		K		KF
P =	½ x 0.5' x 8'	= 2.0 →	x 2.67	= 5.33
U =	½ x 0.5' x 3.5'	= 0.88 ↑	x 2.33	= 2.05

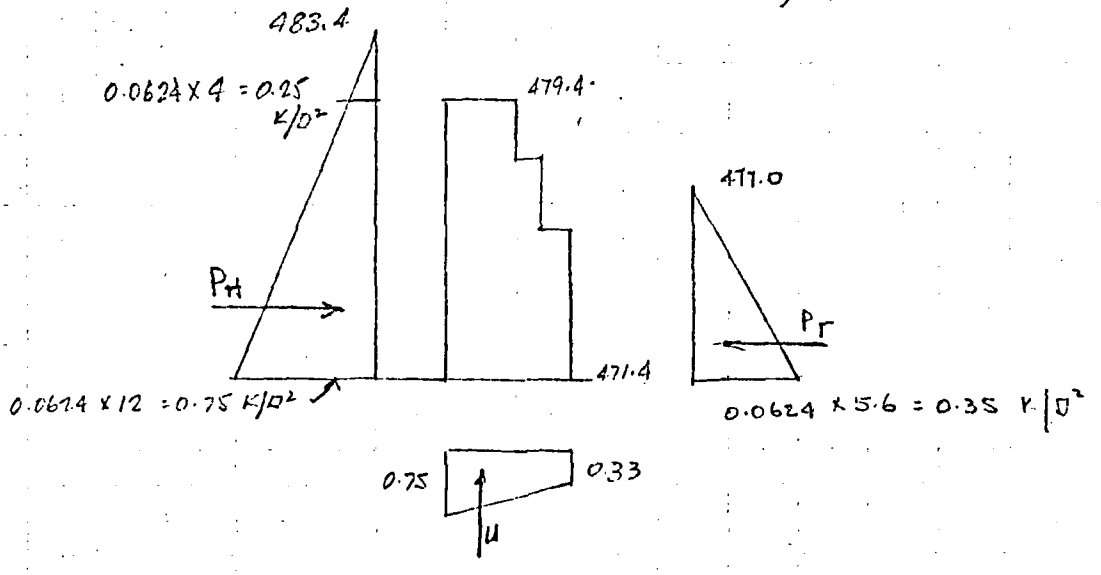
F_V = 0.88 K ↑
F_H = 2.0 K →
M_R = 0
M_O = 7.33 KF

TAMS

Job No. 1511 Sheet 5 of 12
Project NY 5 Dam Inspection Date 8-5-80
Subject LK SUFFERN - STABILITY ANALYSIS By JP
OF SPILLWAY Ch'k. by

UNUSUAL LOADING WL Equal to ½ PMF

El. 483.4 ; Tailwater El. 477.0



$$P_H = \left(\frac{0.25 + 0.75}{2}\right) 8 : \underset{K}{4.0} \times 3.33' = \underset{KF}{13.32}$$

$$P_T \quad \left(\tfrac{1}{2} \times 0.35 \times 5.6\right) 0.6 = 0.59 \times 1.9' = 1.12 \qquad 60\%\ TW\ P_{T=477}$$

$$U = \left(\frac{0.35 + 0.75}{2}\right) 3.5 = 1.93 \times 1.98' = 3.81$$

$F_V = 1.93 \uparrow$

$F_H = 3.41^K \rightarrow$

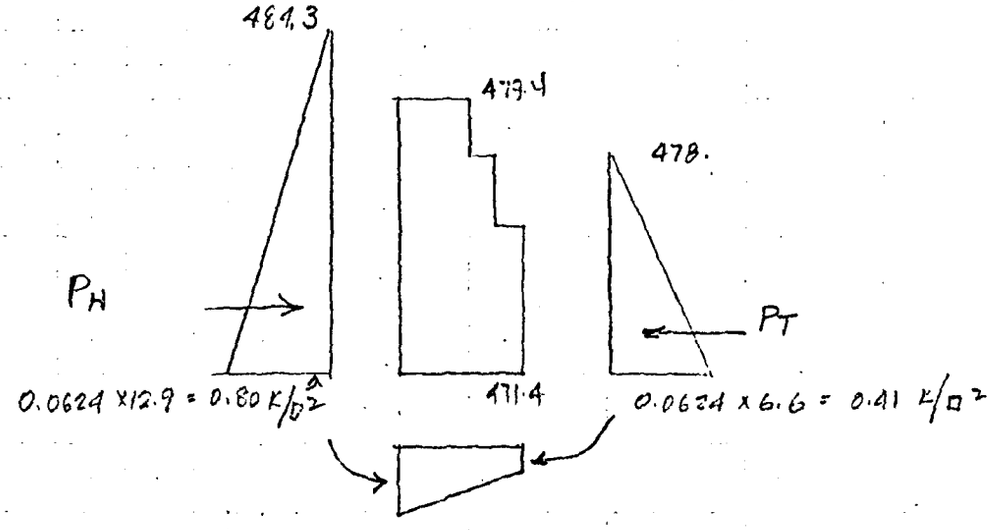
$M_R = 1.12^{KF}$

$M_O = 17.13^{KF}$

TAMS

Job No. 1511 Sheet 6 of 12
Project PHASE I DAM INSPECTION Date 8-5-80
Subject STABILITY ANALYSIS - LK SUTTADE By JP
Ch'k. by

MAXIMUM LOADING WL EQUAL TO PMF LEVEL 484.3
TAIL WATER 478.0



ΣM @ Toe

		K		KF
P_H	$= \left(\frac{0.31+0.80}{2}\right)8$	$= 4.44 \rightarrow$	$\times 3.41$	$= 15.14$
U	$= \left(\frac{0.41+0.80}{2}\right)3.5$	$= 2.12 \uparrow$	$\times 1.93$	$= 4.09$
P_T	$= \left(\frac{1}{2} \times 0.41 \times 6.6\right)0.6$	$= 0.81 \leftarrow$	$\times 2.2$	$= 1.78$

$F_V = 2.12^K \uparrow$

$F_H = 3.63^K \rightarrow$

$M_R = 1.78^{KF}$

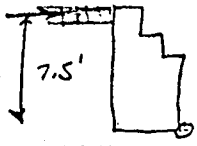
$M_O = 19.23$

TAMS

Job No. 1511 Sheet 7 of 12
Project N Y STATE DAM INSPECTION Date 8-5-80
Subject STABILITY ANALYSIS — LK SUTANNE By JP
Ch'k. by

ICE LOAD

$5 \times 7.5' = 37.5^{KF}$



CASE I NORMAL LOADING — WL at SPILLWAY CREST
NO ICE LOAD

	F_V	F_H	M_R	M_O
Dead Load	3.58	—	6.96	—
Hydrostatic	0.88	2.0	—	7.38
	2.70	2.0	6.96	7.38

$EM = 6.96 - 7.38 = -0.42^{KF}$

$e = \frac{3.5}{2} - \frac{-0.42}{2.70} = 1.75 + 0.15 = 1.90'$ D/s From ℄

Resultant location

$\frac{-0.42}{2.70} - \frac{3.5}{3} = -0.15 - 1.17 = 1.32'$ outside middle third.

$p = \frac{2.70}{3.5}\left(1 \pm \frac{6 \times 1.90}{3.5}\right)\frac{1000}{144} =$

23 psi at Toe
−12 psi at Heel

FRICTION FACTOR OF SAFETY

$FFS = \frac{2.70 \times \tan 35^\circ}{2} = 0.95$

TAMS

Job No. 1511 Sheet 8 of 17
Project N.Y. State Dam Inspection Date 8-5-80
Subject Stability Analysis - LK. SUEANNE By JP
Ch'k. by

CASE II NORMAL LOADING WITH ICE LOAD; AND W.L SPILLWAY CREST

	F_V	F_H	M_R	M_O
Dead load	3.58 ↓		6.96	
Hydrostatic	0.88 ↑	2.0		7.4
Ice load		5.0		37.5
	2.70	7.0	6.96	44.9

$EM = 6.96 - 44.9 = -37.9$ KF

$e = \frac{3.5}{2} - \frac{-37.9}{270} = 1.75 + 14.0 = 15.75'$ d/s from $\hat{\ell}$

Resultant location

$-\frac{37.9}{2.70} - \frac{3.5}{3} = -14.0 - 1.17 = -15.17'$ outside middle third

$p = \frac{2.7^{KF}}{3.5}\left(1 \pm \frac{6 \times 15.75}{3.5}\right)\frac{1000}{144} = (5 \pm 145)$

$= 150$ psi @ Toe
-140 psi @ heel

Friction Factor of Safety

$FFS = \frac{2.70 \tan 35^\circ}{7.0} = \frac{1.89}{7.0} = 0.27 < 1.5$

TAMS

Job No. _____ Sheet 9 of 12

Project N.Y.S Dam Inspection Date 8-5-80

Subject LK SUSQUANNA DAM - PHASE I INSPECTION By JP

Ch'k. by _____

CASE III UNUSUAL LOADING : 1/2 PMF

	F_V	F_H	M_R	M_O
Dead load	3.58↓	–	6.96	
Hydrostatic	1.93↑	3.41	1.12	17.13
	1.65	3.41	8.08	17.13

$EM = 8.08 - 17.13 = -9.05$ LF

$e = \frac{3.5}{2} - \frac{-9.05}{1.69} = 7.11$ 'd/s from ℄

RESULTANT LOCATION

$-\frac{9.05}{1.65} - \frac{3.5}{3} = -6.65$ ' out side middle third.

$p = \frac{1.65}{3.5}\left(1 \pm \frac{6 \times 7.11}{3.5}\right)\frac{1000}{144} = (3 \pm 55)$

43 psi @ Toe

-37 psi @ Heel

FRICTION FACTOR OF SAFETY

$FFS = \frac{1.69 \tan 35°}{3.41} = \frac{1.18}{3.41} = 0.35 < 1.25$

TAMS

Job No. 1511 Sheet 10 of 12
Project N.Y.S. DAM INSPECTION Date 8-5-80
Subject CK SUSANNE DAM - STABILITY By JP
ANALYSIS Ch'k. by

CASE IV EXTREME LOADING = PMF

	F_V	F_H	M_R	M_O
Dead load	3.58		6.96	
Hydrostatic	2.12	3.63	1.78	19.23
	1.46	3.63	8.74	19.23

$$EM = 8.74 - 19.23 = -10.49^{KF}$$

$$e = \frac{3.5}{2} - \frac{-10.49}{1.46} = 1.75 + 7.18 = 8.93' \text{ d/s from } \mathcal{L}$$

RESULTANT LOCATION

$$\frac{-10.49}{1.46} - \frac{3.5}{3} = -7.18 - 1.17 = 8.35' \text{ outside middle third}$$

$$p = \frac{1.46}{3.5}\left(1 \pm \frac{6 \times 8.93}{3.5}\right)\frac{1000}{144} =$$

47 psi @ Toe
-41 psi @ Heel

FRICTION FACTOR OF SAFETY

$$FFS = \frac{1.46 \tan 35^\circ}{3.63} = 0.28$$

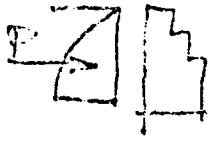
LK SUCTIONE STABILITY ANALYSIS

8/5/...

CASE IV : Normal loading with Earthquake
Reservoir level at El. 777.4

Zone 2 : 0.05
Zangers Method $C = 0.726$ when $\theta = 0°$

1) Hydrodynamic Forces



$$P = 0.726 \times 0.05 \times 0.0624 \times 8^2 = 0.14 \text{ kips}$$

$$M_D = 0.14 (0.4 \times 8) = 0.45 \text{ K-F}$$

2 Dynamic Forces

$$W_D = 0.05(2.7) = 0.14 \text{ K}$$

$$M_{WD} = 0.14 \times \bar{y} = 0.14 \times 3.58 = 0.50 \text{ K-F}$$

	F_V	F_H	M_C	M_O
Dead load	3.58 ↓	0.0	6.96	—
Hydrostatic	0.88 ↑	2.0 →	0	7.58
Hydrodynamic	—	0.14 →		0.45
Dynamic	—	0.14 →		0.50
Σ	2.7	2.28 →	6.96	8.33

Sheet 12 of 14
BY JP
8/5/10

$$\Sigma M = 6.96 - 8.33 = -1.37 \text{ k-ft}$$

Resultant location $\frac{-1.37}{2.7} - \frac{-3.5}{-4} = -0.50 - 0.88$

$= -1.38$ ft outside kern of footing

$$e = \frac{3.5}{2} - -0.50 = 1.75 + 0.50 = 2.25 \text{ ft from toe } L.$$

$$p = \frac{2.7}{3.5}\left(1 \pm \frac{6 \times 2.25}{3.5}\right)\frac{1.50}{1.14} = 5 \pm 19$$

24 ksf
-14 ksf

FRICTION FACTOR OF SAFETY

$$FFS = \frac{27 \tan 35^\circ}{2.2} = 0.86 < 1.25$$

REFERENCES

APPENDIX F

References

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2. "Lower Hudson River Basin Hydrolic Flood Routing Model" for New York District Corps of Engineers, Water Resources Engineers, Inc., January 1977

3. "Standard Project Flood Determination", EM-1110-2-1411, Army Corps of Engineers, Washington, D.C., Rev. 1965

4. "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6,12,24 and 48 Hours",Hydrometerological report No.33. April 1956.

5. "National Program of Inspection of Dams", Vol. 3, Department of the Army, Office of the Chief of Engineers, 1975

6. "Flood Hydrograph Analyses and Computations", EM-1110-2-1405, U.S. Army Corps of Engineers, August, 1959

7. "Recommended Guidelines for Safety Inspection of Dams", Department of the Army, Office of the Chief of Engineers, Appendix D

8. "The Geology of New York State", by Broughton, J.E., et al., N.Y. State Museum and Science Service, Geological Survey, Albany, New York, Map and Chart Series: No. 5, 1962

9. "Soil Association Map of New York State", by M.G. Cline, New York State College of Agriculture, Cornell University, Ithaca, New York, February, 1963

10. "Orange County Soils. Soil Association Leaflet 2", by E.G. Knox, et al., New York State College of Agriculture, Cornell University, Ithaca, New York, October, 1954

END

DATE
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